ONE HORTON HEATH, EASTLEIGH

FLOOD RISK ASSESSMENT

EASTLEIGH BOROUGH COUNCIL

PART 5 OF 5

APPENDICES 7 - 15

Document Reference: G277-DOC01-FRA-Issue 2

MAY 2021

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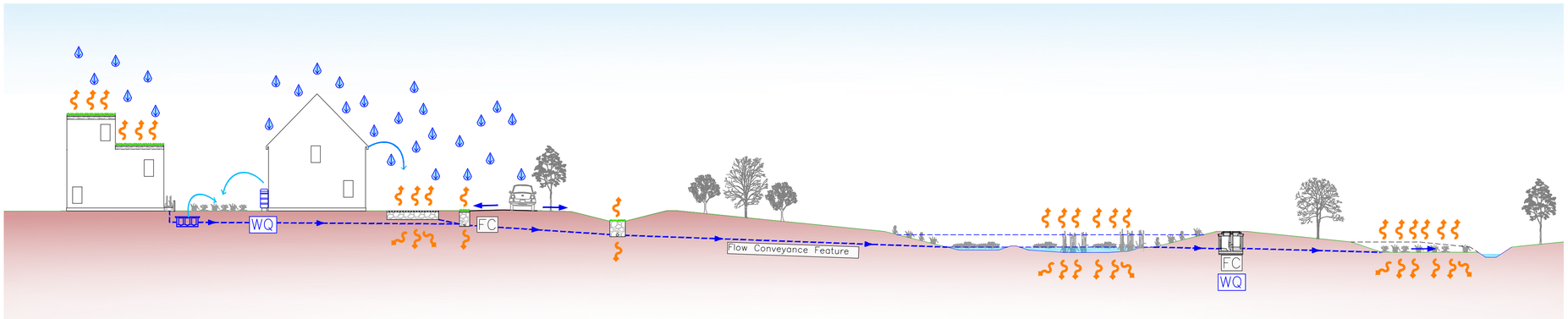
engineering the future

Appendix 7

KEY

- Rainfall
- Interception Losses (Evapotranspiration / Infiltration)
- Water Reuse
- WQ — Water Quality Device (Oil Separator / Vortex Separator)
- FC — Flow Control Device (Orifice / Vortex Flow Control)
- Overland Flow
- Surface Water Sewer (connecting SuDS Features)



DEVELOPMENT TYPE	Commercial / Public	Residential	Private / Shared Parking	Public Highway	Conveyance Features		Green Infrastructure / Public Open Space	Watercourse Corridor
MANAGEMENT TRAIN	PREVENTION SOURCE CONTROL			SITE / REGIONAL CONTROL				
SuDS FEATURE	Rainwater Harvesting (Reuse for irrigation e.g Rainwater Butts) Green Roofs Bioretention Areas / Rain Gardens Rills	Rainwater Harvesting (Reuse for irrigation e.g Rainwater Butts) Porous Paving Tanks Flow Control Devices		Swales Bioretention Areas Filter Strips Filter Drains			Strategic SuDS incorporating sediment forbays, wetland areas, micropools at the outlet Flow Control Devices Water Quality Devices	Outfall Swale
MAINTENANCE RESPONSIBILITY	Commercial or Public Tenants	Homeowners	Homeowners / Management Company	Highway Authority	Southern Water / Management Company		Southern Water / Management Company	Southern Water / Management Company

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For Planning
This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOTES

1. Drawing to be read in conjunction with Flood Risk Assessment and Water Management Strategy produced by PFA Consulting (Document Ref: G277-DOC01 Issue 2, Dated May 2021) and Preliminary Water Management Strategy Plan (Drawing No. G277/21 Rev C & G277/22 Rev C).
2. Future design of upstream Source Control & Site Control to take account of the principles established in in the Water Management Strategy and this drawing.

Rev	Date	Description	Drawn	Check
#	26.11.20	First Issue.	BF	MWS
A	21.05.21	Cross references updated	DAB	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath
Hampshire

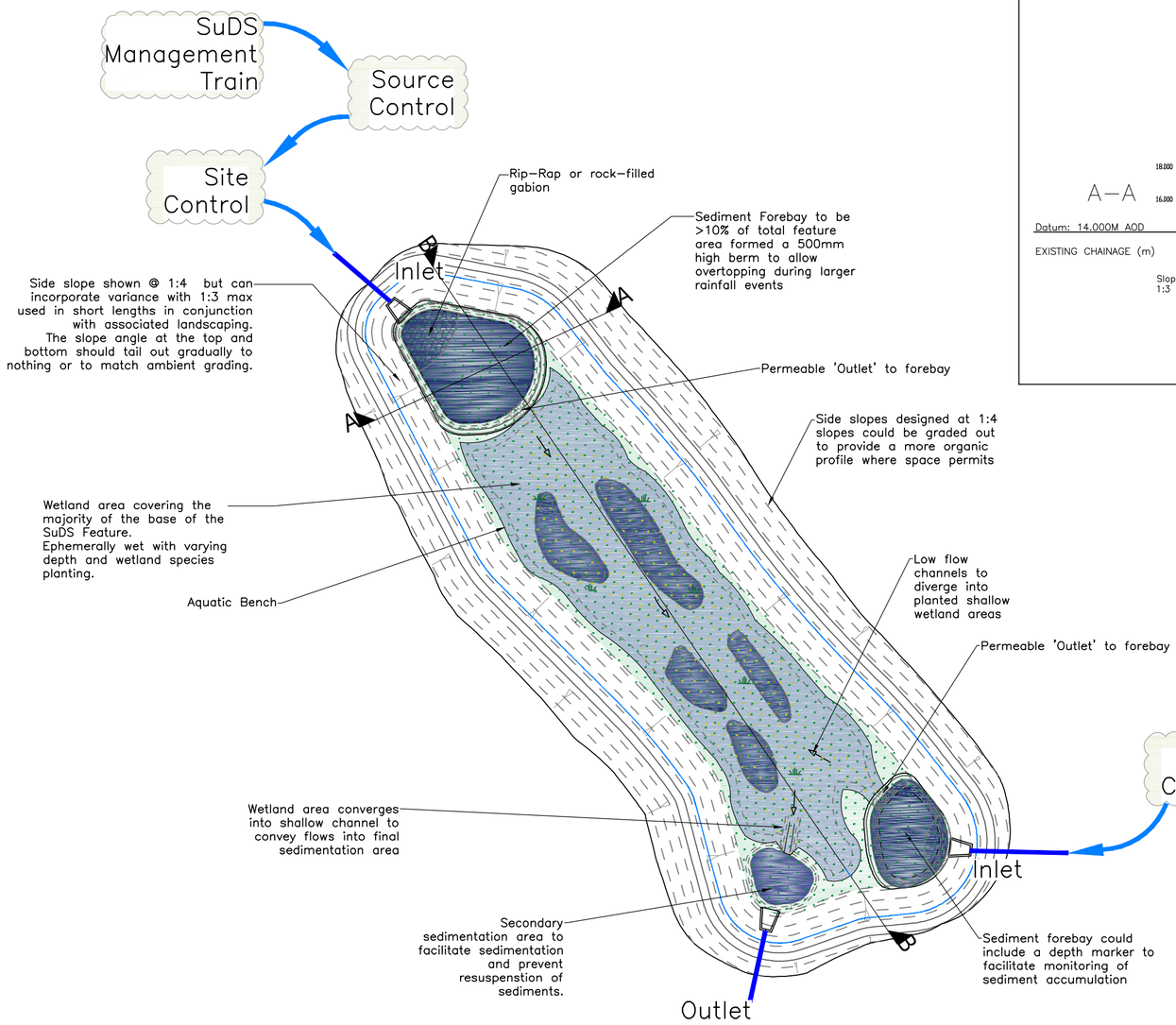
Drawing Title
SuDS Management Train

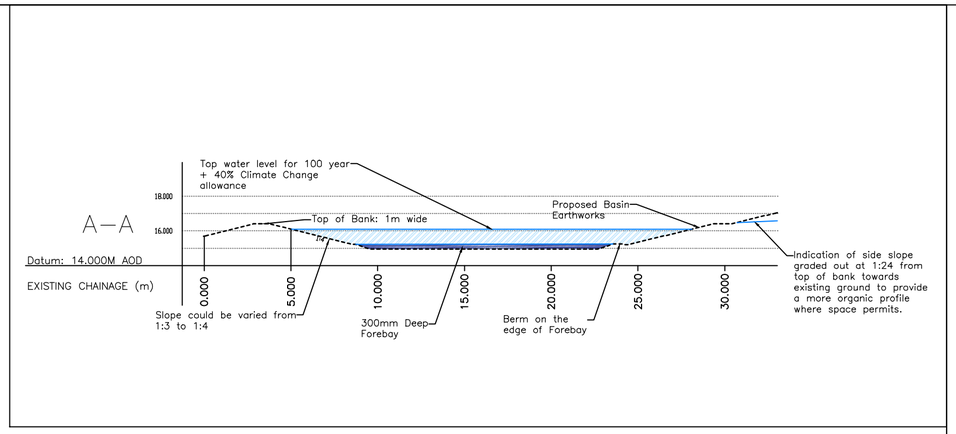
Drawing No. G277/24 Rev A

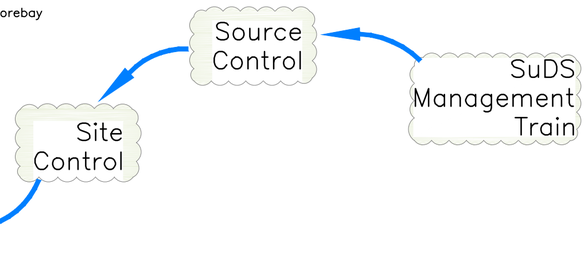
Date: November 2020 | Scale: NTS @ A1

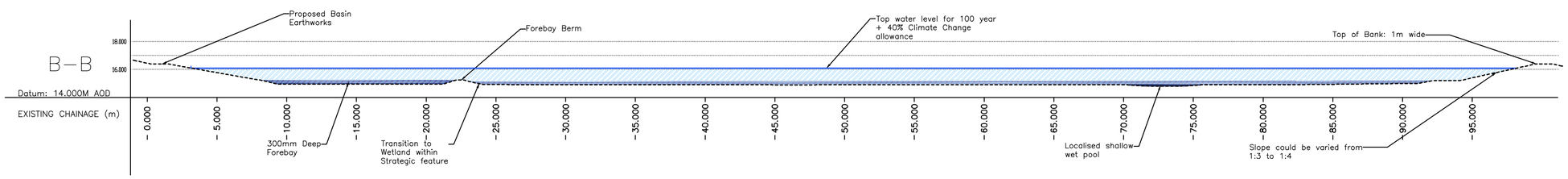
E-Mail: bfox@pfaplc.com

Appendix 8









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For Planning
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NOTES

1. This drawing shows the typical SuDS feature arrangements for the SuDS features shown on the Preliminary Water Management Strategy Plan, Drawing number G277/21 Rev C & G277/22 Rev C.
2. Upstream SuDS management train principles are outlined in the PFA's Water Management Strategy and depicted on drawing G277/24 dated May 2021.

Rev	Date	Description	Drawn	Check
#	26/11/20	First Issue.	DAB	SAM
A	21/05/21	Cross references updated	DAB	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath
Hampshire

Drawing Title
Typical Layout of Strategic SuDS Features to Inform Detailed Design

Drawing No. G277/23 Rev A

Date: November 2020 | Scale: As shown

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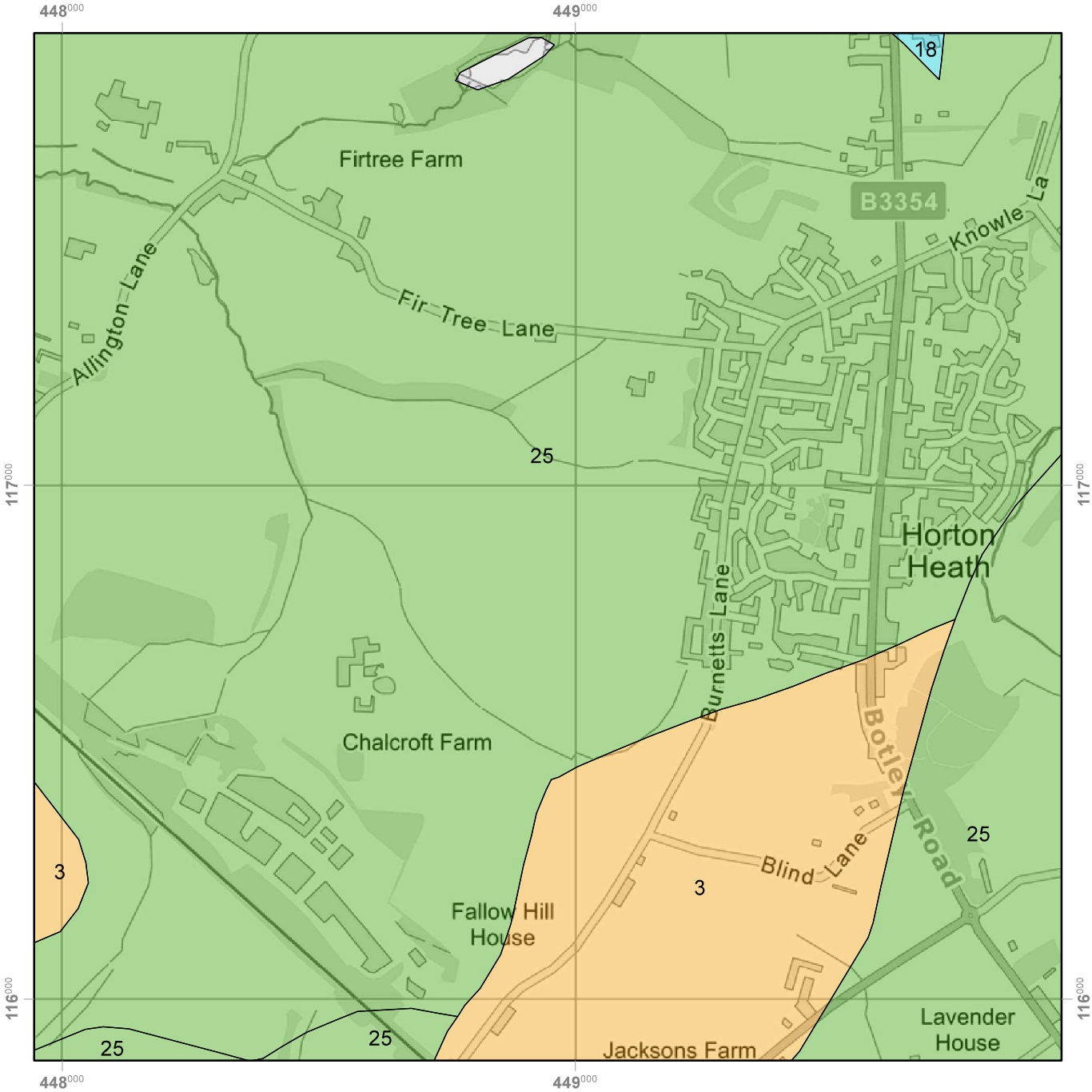
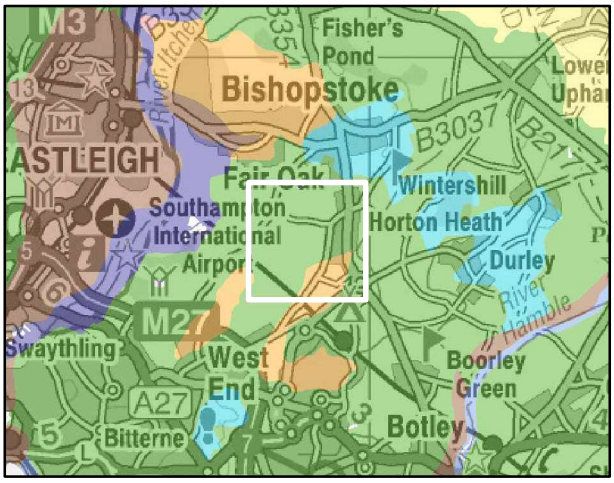
Appendix 9

1b Hydrology of Soil Type (HOST)



Soils Data © Cranfield University (NSRI) and for the Controller of HMSO 2018

Contains OS data © Crown Copyright and database right 2017



Hydrology of Soil Type (HOST) Key

3 Free draining permeable soils on soft sandstone substrates with relatively high permeability and high storage capacity

18 Slowly permeable soils with slight seasonal waterlogging and moderate storage capacity over slowly permeable substrates with negligible storage

25 Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity

HOST CLASS DESCRIPTION

The Hydrology of Soil Types (HOST) classification describes the dominant pathways of water movement through the soil and, where appropriate, the underlying substrate. Eleven drainage models are defined according to the permeability of the soil and its substrate and the depth to a groundwater table, where one is present (Boorman et al,1995). These are further subdivided into 29 HOST classes to which all soil series have been assigned. These classes identify the way soil water flows are partitioned, with water passing over, laterally through, or vertically down the soil column. Analysis of the river hydrograph and the extent of soil series for several hundred gauged catchments allowed mean values for catchment hydrological variables to be identified for each HOST class, The HOST classification is widely used to predict river flows and the frequency and severity of flood events and also to model the behaviour of diffuse pollutants (Hollis et al, 1995).

Appendix 10

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Philipp Schilbach
Site name:	Land at Horton Heath
Site location:	Eastleigh, Hampshire

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be
the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.95332° N
Longitude:	1.30842° W
Reference:	1237022321
Date:	Oct 22 2019 14:24

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	1

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST
HOST class:	25
BFI / BFIHOST:	0.17
Q_{MED} (l/s):	8.1
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	800	800
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	9.2	9.2
1 in 1 year (l/s):	7.82	7.82
1 in 30 years (l/s):	21.17	21.17
1 in 100 year (l/s):	29.36	29.36
1 in 200 years (l/s):	34.42	34.42

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix 11

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.612	0.112	8.1	82.5	O K
30 min Summer	15.641	0.141	11.7	104.9	O K
60 min Summer	15.667	0.167	14.7	125.1	O K
120 min Summer	15.687	0.187	16.6	140.7	O K
180 min Summer	15.696	0.196	17.5	148.3	O K
240 min Summer	15.701	0.201	17.6	152.1	O K
360 min Summer	15.701	0.201	17.6	152.2	O K
480 min Summer	15.697	0.197	17.5	149.1	O K
600 min Summer	15.692	0.192	17.1	145.1	O K
720 min Summer	15.687	0.187	16.6	140.7	O K
960 min Summer	15.676	0.176	15.6	132.4	O K
1440 min Summer	15.659	0.159	13.8	118.8	O K
2160 min Summer	15.641	0.141	11.7	104.7	O K
2880 min Summer	15.629	0.129	10.2	95.1	O K
4320 min Summer	15.613	0.113	8.2	82.6	O K
5760 min Summer	15.602	0.102	6.9	74.6	O K
7200 min Summer	15.594	0.094	6.0	68.9	O K
8640 min Summer	15.588	0.088	5.4	64.4	O K
10080 min Summer	15.584	0.084	4.9	60.8	O K
15 min Winter	15.625	0.125	9.7	92.1	O K
30 min Winter	15.657	0.157	13.6	117.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	80.6	25
30 min Summer	19.618	0.0	109.3	37
60 min Summer	12.728	0.0	147.5	60
120 min Summer	8.110	0.0	188.9	92
180 min Summer	6.206	0.0	217.3	126
240 min Summer	5.126	0.0	239.7	160
360 min Summer	3.877	0.0	272.3	228
480 min Summer	3.179	0.0	297.9	292
600 min Summer	2.725	0.0	319.4	356
720 min Summer	2.403	0.0	338.1	420
960 min Summer	1.972	0.0	369.8	544
1440 min Summer	1.492	0.0	419.4	786
2160 min Summer	1.128	0.0	479.6	1152
2880 min Summer	0.925	0.0	524.1	1508
4320 min Summer	0.700	0.0	593.1	2248
5760 min Summer	0.575	0.0	654.0	2952
7200 min Summer	0.492	0.0	699.9	3680
8640 min Summer	0.433	0.0	738.2	4416
10080 min Summer	0.389	0.0	771.0	5144
15 min Winter	29.494	0.0	91.0	24
30 min Winter	19.618	0.0	123.2	36

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	15.686	0.186	16.5	140.2	O K
120 min Winter	15.707	0.207	17.7	156.6	O K
180 min Winter	15.715	0.215	17.8	163.2	O K
240 min Winter	15.717	0.217	17.8	164.8	O K
360 min Winter	15.710	0.210	17.7	159.6	O K
480 min Winter	15.700	0.200	17.6	151.6	O K
600 min Winter	15.691	0.191	17.0	144.1	O K
720 min Winter	15.682	0.182	16.2	137.1	O K
960 min Winter	15.667	0.167	14.7	125.2	O K
1440 min Winter	15.646	0.146	12.3	108.4	O K
2160 min Winter	15.626	0.126	9.8	92.9	O K
2880 min Winter	15.613	0.113	8.3	83.1	O K
4320 min Winter	15.597	0.097	6.4	71.0	O K
5760 min Winter	15.587	0.087	5.3	63.7	O K
7200 min Winter	15.580	0.080	4.5	58.4	O K
8640 min Winter	15.575	0.075	4.0	54.4	O K
10080 min Winter	15.571	0.071	3.6	51.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	165.7	60
120 min Winter	8.110	0.0	212.0	98
180 min Winter	6.206	0.0	243.8	136
240 min Winter	5.126	0.0	268.9	174
360 min Winter	3.877	0.0	305.4	244
480 min Winter	3.179	0.0	334.1	310
600 min Winter	2.725	0.0	358.2	374
720 min Winter	2.403	0.0	379.2	438
960 min Winter	1.972	0.0	414.8	564
1440 min Winter	1.492	0.0	470.4	808
2160 min Winter	1.128	0.0	537.5	1172
2880 min Winter	0.925	0.0	587.4	1532
4320 min Winter	0.700	0.0	665.0	2256
5760 min Winter	0.575	0.0	732.7	3000
7200 min Winter	0.492	0.0	784.2	3744
8640 min Winter	0.433	0.0	827.2	4408
10080 min Winter	0.389	0.0	864.4	5152

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.584

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.500	4	8	0.500	8	12	0.584

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Model Details

Storage is Online Cover Level (m) 16.700

Tank or Pond Structure

Invert Level (m) 15.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	706.6	0.401	912.5	0.801	1134.6	1.200	1372.1
0.101	756.5	0.501	966.6	0.901	1192.6		
0.201	807.5	0.601	1021.6	1.001	1251.7		
0.301	859.5	0.701	1077.6	1.101	1311.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0192-1830-0900-1830
Design Head (m)	0.900
Design Flow (l/s)	18.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	192
Invert Level (m)	15.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	18.3
Flush-Flo™	0.319	18.3
Kick-Flo®	0.658	15.8
Mean Flow over Head Range	-	15.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	21.0	3.000	32.5	7.000	49.0
0.200	17.6	1.400	22.6	3.500	35.0	7.500	50.7
0.300	18.2	1.600	24.1	4.000	37.4	8.000	52.3
0.400	18.1	1.800	25.5	4.500	39.6	8.500	53.9
0.500	17.7	2.000	26.8	5.000	41.6	9.000	55.4
0.600	16.8	2.200	28.0	5.500	43.6	9.500	56.6
0.800	17.3	2.400	29.2	6.000	45.5		
1.000	19.2	2.600	30.4	6.500	47.3		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.963	0.463	18.3	381.4	O K
30 min Summer	16.092	0.592	18.3	507.7	O K
60 min Summer	16.216	0.716	18.3	638.5	O K
120 min Summer	16.261	0.761	18.3	687.5	O K
180 min Summer	16.274	0.774	18.3	702.4	O K
240 min Summer	16.274	0.774	18.3	702.6	O K
360 min Summer	16.258	0.758	18.3	684.7	O K
480 min Summer	16.241	0.741	18.3	666.3	O K
600 min Summer	16.225	0.725	18.3	647.9	O K
720 min Summer	16.208	0.708	18.3	629.7	O K
960 min Summer	16.173	0.673	18.3	592.6	O K
1440 min Summer	16.100	0.600	18.3	516.6	O K
2160 min Summer	16.002	0.502	18.3	419.2	O K
2880 min Summer	15.919	0.419	18.3	340.7	O K
4320 min Summer	15.800	0.300	18.2	234.3	O K
5760 min Summer	15.730	0.230	17.9	175.8	O K
7200 min Summer	15.696	0.196	17.5	148.2	O K
8640 min Summer	15.681	0.181	16.1	136.2	O K
10080 min Summer	15.670	0.170	15.0	127.6	O K
15 min Winter	16.012	0.512	18.3	429.0	O K
30 min Winter	16.154	0.654	18.3	572.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	390.5	26
30 min Summer	90.183	0.0	525.8	40
60 min Summer	57.866	0.0	683.0	70
120 min Summer	32.885	0.0	776.7	126
180 min Summer	23.621	0.0	837.0	184
240 min Summer	18.682	0.0	882.8	242
360 min Summer	13.435	0.0	952.4	322
480 min Summer	10.653	0.0	1007.0	384
600 min Summer	8.910	0.0	1052.8	446
720 min Summer	7.706	0.0	1092.6	514
960 min Summer	6.140	0.0	1160.6	654
1440 min Summer	4.483	0.0	1270.5	916
2160 min Summer	3.294	0.0	1405.8	1300
2880 min Summer	2.663	0.0	1515.4	1672
4320 min Summer	2.002	0.0	1706.1	2344
5760 min Summer	1.655	0.0	1885.5	3016
7200 min Summer	1.442	0.0	2053.3	3680
8640 min Summer	1.297	0.0	2216.4	4416
10080 min Summer	1.193	0.0	2376.1	5144
15 min Winter	134.447	0.0	438.1	26
30 min Winter	90.183	0.0	589.4	40

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	16.289	0.789	18.3	719.4	O K
120 min Winter	16.340	0.840	18.3	778.0	O K
180 min Winter	16.358	0.858	18.3	798.4	O K
240 min Winter	16.361	0.861	18.3	802.5	O K
360 min Winter	16.349	0.849	18.3	787.6	O K
480 min Winter	16.325	0.825	18.3	760.5	O K
600 min Winter	16.305	0.805	18.3	737.7	O K
720 min Winter	16.284	0.784	18.3	713.6	O K
960 min Winter	16.238	0.738	18.3	662.1	O K
1440 min Winter	16.133	0.633	18.3	550.4	O K
2160 min Winter	15.976	0.476	18.3	393.6	O K
2880 min Winter	15.849	0.349	18.3	277.1	O K
4320 min Winter	15.705	0.205	17.7	155.3	O K
5760 min Winter	15.672	0.172	15.2	128.9	O K
7200 min Winter	15.655	0.155	13.3	115.4	O K
8640 min Winter	15.644	0.144	12.1	107.0	O K
10080 min Winter	15.637	0.137	11.1	101.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	765.3	68
120 min Winter	32.885	0.0	870.2	124
180 min Winter	23.621	0.0	937.8	182
240 min Winter	18.682	0.0	989.1	238
360 min Winter	13.435	0.0	1067.1	346
480 min Winter	10.653	0.0	1128.2	410
600 min Winter	8.910	0.0	1179.5	474
720 min Winter	7.706	0.0	1224.1	550
960 min Winter	6.140	0.0	1300.2	706
1440 min Winter	4.483	0.0	1423.3	1002
2160 min Winter	3.294	0.0	1574.9	1384
2880 min Winter	2.663	0.0	1697.7	1732
4320 min Winter	2.002	0.0	1911.8	2332
5760 min Winter	1.655	0.0	2111.9	3000
7200 min Winter	1.442	0.0	2300.0	3688
8640 min Winter	1.297	0.0	2482.9	4416
10080 min Winter	1.193	0.0	2662.4	5136

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.584

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.500	4	8	0.500	8	12	0.584

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Model Details

Storage is Online Cover Level (m) 16.700

Tank or Pond Structure

Invert Level (m) 15.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	706.6	0.401	912.5	0.801	1134.6	1.200	1372.1
0.101	756.5	0.501	966.6	0.901	1192.6		
0.201	807.5	0.601	1021.6	1.001	1251.7		
0.301	859.5	0.701	1077.6	1.101	1311.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0192-1830-0900-1830
Design Head (m)	0.900
Design Flow (l/s)	18.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	192
Invert Level (m)	15.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	18.3
Flush-Flo™	0.319	18.3
Kick-Flo®	0.658	15.8
Mean Flow over Head Range	-	15.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	21.0	3.000	32.5	7.000	49.0
0.200	17.6	1.400	22.6	3.500	35.0	7.500	50.7
0.300	18.2	1.600	24.1	4.000	37.4	8.000	52.3
0.400	18.1	1.800	25.5	4.500	39.6	8.500	53.9
0.500	17.7	2.000	26.8	5.000	41.6	9.000	55.4
0.600	16.8	2.200	28.0	5.500	43.6	9.500	56.6
0.800	17.3	2.400	29.2	6.000	45.5		
1.000	19.2	2.600	30.4	6.500	47.3		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.018	0.118	10.6	127.2	O K
30 min Summer	21.049	0.149	15.6	162.7	O K
60 min Summer	21.077	0.177	20.4	196.1	O K
120 min Summer	21.098	0.198	23.8	221.1	O K
180 min Summer	21.108	0.208	25.3	233.7	O K
240 min Summer	21.114	0.214	26.0	240.4	O K
360 min Summer	21.115	0.215	26.2	242.5	O K
480 min Summer	21.113	0.213	26.0	239.5	O K
600 min Summer	21.109	0.209	25.4	234.5	O K
720 min Summer	21.104	0.204	24.7	228.8	O K
960 min Summer	21.095	0.195	23.2	217.2	O K
1440 min Summer	21.079	0.179	20.6	197.5	O K
2160 min Summer	21.060	0.160	17.5	175.6	O K
2880 min Summer	21.047	0.147	15.3	160.2	O K
4320 min Summer	21.030	0.130	12.4	139.9	O K
5760 min Summer	21.018	0.118	10.5	126.4	O K
7200 min Summer	21.009	0.109	9.2	116.9	O K
8640 min Summer	21.003	0.103	8.2	109.3	O K
10080 min Summer	20.997	0.097	7.4	103.3	O K
15 min Winter	21.031	0.131	12.6	142.0	O K
30 min Winter	21.065	0.165	18.3	181.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	121.9	28
30 min Summer	19.618	0.0	165.9	39
60 min Summer	12.728	0.0	225.9	62
120 min Summer	8.110	0.0	289.5	96
180 min Summer	6.206	0.0	333.2	130
240 min Summer	5.126	0.0	367.6	164
360 min Summer	3.877	0.0	417.6	230
480 min Summer	3.179	0.0	457.0	296
600 min Summer	2.725	0.0	490.1	360
720 min Summer	2.403	0.0	518.8	424
960 min Summer	1.972	0.0	567.4	548
1440 min Summer	1.492	0.0	643.3	794
2160 min Summer	1.128	0.0	737.1	1156
2880 min Summer	0.925	0.0	805.4	1528
4320 min Summer	0.700	0.0	910.9	2252
5760 min Summer	0.575	0.0	1005.7	2960
7200 min Summer	0.492	0.0	1076.2	3680
8640 min Summer	0.433	0.0	1134.8	4416
10080 min Summer	0.389	0.0	1184.9	5144
15 min Winter	29.494	0.0	137.9	28
30 min Winter	19.618	0.0	187.3	39

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	21.096	0.196	23.5	219.2	O K
120 min Winter	21.118	0.218	26.6	245.6	O K
180 min Winter	21.127	0.227	27.8	256.3	O K
240 min Winter	21.129	0.229	28.1	259.6	O K
360 min Winter	21.125	0.225	27.6	254.5	O K
480 min Winter	21.118	0.218	26.6	245.2	O K
600 min Winter	21.110	0.210	25.5	235.2	O K
720 min Winter	21.102	0.202	24.3	225.4	O K
960 min Winter	21.088	0.188	22.1	208.2	O K
1440 min Winter	21.066	0.166	18.5	182.6	O K
2160 min Winter	21.045	0.145	14.9	157.5	O K
2880 min Winter	21.031	0.131	12.5	141.3	O K
4320 min Winter	21.013	0.113	9.7	121.0	O K
5760 min Winter	21.002	0.102	8.1	108.4	O K
7200 min Winter	20.994	0.094	7.0	99.4	O K
8640 min Winter	20.988	0.088	6.2	92.6	O K
10080 min Winter	20.983	0.083	5.5	87.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	253.7	62
120 min Winter	8.110	0.0	325.0	102
180 min Winter	6.206	0.0	374.0	138
240 min Winter	5.126	0.0	412.5	174
360 min Winter	3.877	0.0	468.6	246
480 min Winter	3.179	0.0	512.8	314
600 min Winter	2.725	0.0	549.8	380
720 min Winter	2.403	0.0	582.0	444
960 min Winter	1.972	0.0	636.5	570
1440 min Winter	1.492	0.0	721.8	818
2160 min Winter	1.128	0.0	826.1	1188
2880 min Winter	0.925	0.0	902.7	1556
4320 min Winter	0.700	0.0	1021.6	2292
5760 min Winter	0.575	0.0	1126.7	3000
7200 min Winter	0.492	0.0	1205.8	3744
8640 min Winter	0.433	0.0	1271.8	4416
10080 min Winter	0.389	0.0	1328.7	5152

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.437

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.609	4	8	0.609	8	12	0.609	12	16	0.610

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Model Details

Storage is Online Cover Level (m) 22.100

Tank or Pond Structure

Invert Level (m) 20.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1011.9	0.401	1443.0	0.801	1890.0	1.200	2351.9
0.101	1118.2	0.501	1553.3	0.901	2004.3		
0.201	1225.4	0.601	1664.5	1.001	2119.5		
0.301	1333.7	0.701	1776.8	1.101	2235.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	20.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.362	0.462	29.9	581.0	O K
30 min Summer	21.484	0.584	29.9	774.6	O K
60 min Summer	21.602	0.702	29.9	975.7	O K
120 min Summer	21.644	0.744	29.9	1051.0	O K
180 min Summer	21.656	0.756	29.9	1072.8	O K
240 min Summer	21.655	0.755	29.9	1072.0	O K
360 min Summer	21.640	0.740	29.9	1044.0	O K
480 min Summer	21.624	0.724	29.9	1015.4	O K
600 min Summer	21.608	0.708	29.9	986.5	O K
720 min Summer	21.591	0.691	29.9	956.2	O K
960 min Summer	21.554	0.654	29.9	892.2	O K
1440 min Summer	21.485	0.585	29.9	774.8	O K
2160 min Summer	21.390	0.490	29.9	624.5	O K
2880 min Summer	21.312	0.412	29.9	507.0	O K
4320 min Summer	21.203	0.303	29.7	355.6	O K
5760 min Summer	21.144	0.244	29.0	278.4	O K
7200 min Summer	21.119	0.219	26.8	247.4	O K
8640 min Summer	21.104	0.204	24.7	228.9	O K
10080 min Summer	21.094	0.194	23.1	215.5	O K
15 min Winter	21.409	0.509	29.9	654.1	O K
30 min Winter	21.543	0.643	29.9	873.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	598.3	29
30 min Summer	90.183	0.0	806.3	43
60 min Summer	57.866	0.0	1049.5	72
120 min Summer	32.885	0.0	1193.6	128
180 min Summer	23.621	0.0	1286.4	186
240 min Summer	18.682	0.0	1356.8	242
360 min Summer	13.435	0.0	1463.9	316
480 min Summer	10.653	0.0	1547.8	378
600 min Summer	8.910	0.0	1618.2	442
720 min Summer	7.706	0.0	1679.5	510
960 min Summer	6.140	0.0	1784.0	640
1440 min Summer	4.483	0.0	1952.8	906
2160 min Summer	3.294	0.0	2162.1	1284
2880 min Summer	2.663	0.0	2330.5	1648
4320 min Summer	2.002	0.0	2623.0	2336
5760 min Summer	1.655	0.0	2900.3	3000
7200 min Summer	1.442	0.0	3158.3	3688
8640 min Summer	1.297	0.0	3409.0	4416
10080 min Summer	1.193	0.0	3654.0	5144
15 min Winter	134.447	0.0	671.4	29
30 min Winter	90.183	0.0	904.1	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	21.670	0.770	29.9	1100.2	O K
120 min Winter	21.718	0.818	29.9	1189.6	O K
180 min Winter	21.734	0.834	29.9	1219.5	O K
240 min Winter	21.736	0.836	29.9	1224.1	O K
360 min Winter	21.722	0.822	29.9	1197.4	O K
480 min Winter	21.700	0.800	29.9	1155.6	O K
600 min Winter	21.681	0.781	29.9	1118.9	O K
720 min Winter	21.659	0.759	29.9	1079.1	O K
960 min Winter	21.612	0.712	29.9	993.2	O K
1440 min Winter	21.503	0.603	29.9	806.1	O K
2160 min Winter	21.355	0.455	29.9	570.7	O K
2880 min Winter	21.239	0.339	29.9	403.6	O K
4320 min Winter	21.126	0.226	27.7	255.7	O K
5760 min Winter	21.095	0.195	23.3	217.7	O K
7200 min Winter	21.078	0.178	20.5	196.7	O K
8640 min Winter	21.066	0.166	18.5	182.7	O K
10080 min Winter	21.058	0.158	17.1	172.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1176.2	72
120 min Winter	32.885	0.0	1337.5	126
180 min Winter	23.621	0.0	1441.5	182
240 min Winter	18.682	0.0	1520.4	238
360 min Winter	13.435	0.0	1640.2	346
480 min Winter	10.653	0.0	1734.3	396
600 min Winter	8.910	0.0	1813.1	470
720 min Winter	7.706	0.0	1881.8	548
960 min Winter	6.140	0.0	1998.7	702
1440 min Winter	4.483	0.0	2188.0	980
2160 min Winter	3.294	0.0	2422.1	1356
2880 min Winter	2.663	0.0	2610.9	1696
4320 min Winter	2.002	0.0	2939.5	2292
5760 min Winter	1.655	0.0	3248.7	3000
7200 min Winter	1.442	0.0	3537.9	3688
8640 min Winter	1.297	0.0	3819.0	4416
10080 min Winter	1.193	0.0	4094.6	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.437

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.609	4	8	0.609	8	12	0.609	12	16	0.610

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Model Details

Storage is Online Cover Level (m) 22.100

Tank or Pond Structure

Invert Level (m) 20.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1011.9	0.401	1443.0	0.801	1890.0	1.200	2351.9
0.101	1118.2	0.501	1553.3	0.901	2004.3		
0.201	1225.4	0.601	1664.5	1.001	2119.5		
0.301	1333.7	0.701	1776.8	1.101	2235.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	20.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	22.204	0.104	31.9	211.5	O K
30 min Summer	22.232	0.132	38.7	269.9	O K
60 min Summer	22.256	0.156	43.9	319.6	O K
120 min Summer	22.270	0.170	46.9	351.3	O K
180 min Summer	22.275	0.175	47.9	362.0	O K
240 min Summer	22.276	0.176	48.0	363.8	O K
360 min Summer	22.271	0.171	47.0	352.3	O K
480 min Summer	22.263	0.163	45.5	336.6	O K
600 min Summer	22.256	0.156	44.0	320.8	O K
720 min Summer	22.249	0.149	42.5	306.3	O K
960 min Summer	22.237	0.137	39.9	280.6	O K
1440 min Summer	22.218	0.118	35.3	240.6	O K
2160 min Summer	22.197	0.097	30.2	196.9	O K
2880 min Summer	22.182	0.082	26.6	165.7	O K
4320 min Summer	22.161	0.061	21.7	123.3	O K
5760 min Summer	22.147	0.047	18.5	95.1	O K
7200 min Summer	22.137	0.037	16.2	73.4	O K
8640 min Summer	22.129	0.029	14.6	57.2	O K
10080 min Summer	22.122	0.022	13.3	44.2	O K
15 min Winter	22.217	0.117	35.1	238.4	O K
30 min Winter	22.249	0.149	42.4	304.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	243.7	27
30 min Summer	19.618	0.0	324.3	38
60 min Summer	12.728	0.0	421.1	62
120 min Summer	8.110	0.0	537.4	94
180 min Summer	6.206	0.0	617.3	128
240 min Summer	5.126	0.0	679.4	164
360 min Summer	3.877	0.0	770.5	230
480 min Summer	3.179	0.0	842.4	298
600 min Summer	2.725	0.0	903.0	364
720 min Summer	2.403	0.0	955.7	428
960 min Summer	1.972	0.0	1046.2	554
1440 min Summer	1.492	0.0	1187.7	804
2160 min Summer	1.128	0.0	1345.8	1172
2880 min Summer	0.925	0.0	1471.5	1536
4320 min Summer	0.700	0.0	1671.2	2260
5760 min Summer	0.575	0.0	1830.2	3000
7200 min Summer	0.492	0.0	1960.1	3744
8640 min Summer	0.433	0.0	2069.4	4416
10080 min Summer	0.389	0.0	2166.9	5152
15 min Winter	29.494	0.0	272.9	27
30 min Winter	19.618	0.0	363.7	38

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	22.276	0.176	47.9	363.3	O K
120 min Winter	22.292	0.192	50.0	397.1	O K
180 min Winter	22.295	0.195	50.1	405.0	O K
240 min Winter	22.294	0.194	50.1	401.4	O K
360 min Winter	22.282	0.182	49.2	377.3	O K
480 min Winter	22.270	0.170	46.9	351.3	O K
600 min Winter	22.259	0.159	44.6	326.8	O K
720 min Winter	22.249	0.149	42.4	304.7	O K
960 min Winter	22.231	0.131	38.5	268.0	O K
1440 min Winter	22.206	0.106	32.4	215.4	O K
2160 min Winter	22.181	0.081	26.2	163.3	O K
2880 min Winter	22.164	0.064	22.4	128.8	O K
4320 min Winter	22.142	0.042	17.4	84.7	O K
5760 min Winter	22.128	0.028	14.5	56.9	O K
7200 min Winter	22.119	0.019	12.6	36.9	O K
8640 min Winter	22.111	0.011	11.1	21.6	O K
10080 min Winter	22.105	0.005	10.0	9.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	472.1	62
120 min Winter	8.110	0.0	601.3	100
180 min Winter	6.206	0.0	691.4	138
240 min Winter	5.126	0.0	760.9	176
360 min Winter	3.877	0.0	863.2	246
480 min Winter	3.179	0.0	943.9	316
600 min Winter	2.725	0.0	1011.8	382
720 min Winter	2.403	0.0	1070.9	448
960 min Winter	1.972	0.0	1171.0	578
1440 min Winter	1.492	0.0	1330.5	830
2160 min Winter	1.128	0.0	1507.8	1200
2880 min Winter	0.925	0.0	1648.6	1564
4320 min Winter	0.700	0.0	1872.2	2300
5760 min Winter	0.575	0.0	2050.0	3056
7200 min Winter	0.492	0.0	2195.4	3752
8640 min Winter	0.433	0.0	2317.8	4496
10080 min Winter	0.389	0.0	2427.1	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 4.425

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.109	4	8	1.109	8	12	1.109	12	16	1.098

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 23.300

Tank or Pond Structure

Invert Level (m) 22.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1981.6	0.401	2369.6	0.801	2773.7	1.200	3192.8
0.101	2077.1	0.501	2469.2	0.901	2877.3		
0.201	2173.6	0.601	2569.7	1.001	2981.8		
0.301	2271.1	0.701	2671.2	1.101	3087.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0300-5450-1000-5210
Design Head (m)	1.000
Design Flow (l/s)	54.5
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	300
Invert Level (m)	22.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	54.5
Flush-Flo™	0.443	51.9
Kick-Flo®	0.735	47.0
Mean Flow over Head Range	-	42.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.2	1.200	59.5	3.000	92.8	7.000	140.3
0.200	30.9	1.400	64.1	3.500	100.0	7.500	145.2
0.300	50.3	1.600	68.4	4.000	106.8	8.000	149.8
0.400	51.8	1.800	72.4	4.500	113.1	8.500	154.3
0.500	51.8	2.000	76.2	5.000	119.1	9.000	158.7
0.600	50.6	2.200	79.8	5.500	124.7	9.500	163.0
0.800	48.9	2.400	83.3	6.000	130.1		
1.000	54.5	2.600	86.6	6.500	135.3		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	22.574	0.474	51.9	1048.1	O K
30 min Summer	22.714	0.614	51.9	1398.1	O K
60 min Summer	22.848	0.748	51.9	1753.2	O K
120 min Summer	22.892	0.792	51.9	1873.7	O K
180 min Summer	22.901	0.801	51.9	1900.4	O K
240 min Summer	22.897	0.797	51.9	1888.2	O K
360 min Summer	22.874	0.774	51.9	1824.8	O K
480 min Summer	22.852	0.752	51.9	1766.0	O K
600 min Summer	22.832	0.732	51.9	1710.1	O K
720 min Summer	22.812	0.712	51.9	1655.7	O K
960 min Summer	22.772	0.672	51.9	1549.4	O K
1440 min Summer	22.692	0.592	51.9	1342.1	O K
2160 min Summer	22.584	0.484	51.9	1072.6	O K
2880 min Summer	22.497	0.397	51.9	861.8	O K
4320 min Summer	22.376	0.276	51.6	582.9	O K
5760 min Summer	22.306	0.206	50.4	429.0	O K
7200 min Summer	22.274	0.174	47.7	359.3	O K
8640 min Summer	22.256	0.156	44.0	321.6	O K
10080 min Summer	22.243	0.143	41.2	294.0	O K
15 min Winter	22.628	0.528	51.9	1181.4	O K
30 min Winter	22.782	0.682	51.9	1577.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	1114.5	29
30 min Summer	90.183	0.0	1495.2	43
60 min Summer	57.866	0.0	1919.5	72
120 min Summer	32.885	0.0	2181.8	128
180 min Summer	23.621	0.0	2350.4	184
240 min Summer	18.682	0.0	2479.6	242
360 min Summer	13.435	0.0	2673.8	312
480 min Summer	10.653	0.0	2827.3	374
600 min Summer	8.910	0.0	2955.6	438
720 min Summer	7.706	0.0	3068.0	506
960 min Summer	6.140	0.0	3259.0	646
1440 min Summer	4.483	0.0	3569.2	914
2160 min Summer	3.294	0.0	3935.0	1300
2880 min Summer	2.663	0.0	4241.8	1656
4320 min Summer	2.002	0.0	4782.5	2344
5760 min Summer	1.655	0.0	5270.8	3016
7200 min Summer	1.442	0.0	5741.1	3688
8640 min Summer	1.297	0.0	6199.7	4416
10080 min Summer	1.193	0.0	6653.3	5152
15 min Winter	134.447	0.0	1248.4	29
30 min Winter	90.183	0.0	1675.2	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	22.930	0.830	52.6	1979.3	O K
120 min Winter	22.982	0.882	54.0	2128.6	O K
180 min Winter	22.997	0.897	54.4	2171.9	O K
240 min Winter	22.997	0.897	54.4	2170.7	O K
360 min Winter	22.975	0.875	53.8	2107.6	O K
480 min Winter	22.946	0.846	53.1	2027.0	O K
600 min Winter	22.921	0.821	52.4	1956.2	O K
720 min Winter	22.895	0.795	51.9	1882.5	O K
960 min Winter	22.840	0.740	51.9	1732.2	O K
1440 min Winter	22.726	0.626	51.9	1430.5	O K
2160 min Winter	22.555	0.455	51.9	1000.9	O K
2880 min Winter	22.425	0.325	51.9	693.6	O K
4320 min Winter	22.285	0.185	49.7	381.9	O K
5760 min Winter	22.247	0.147	42.0	301.4	O K
7200 min Winter	22.225	0.125	37.0	255.7	O K
8640 min Winter	22.211	0.111	33.5	224.9	O K
10080 min Winter	22.200	0.100	31.0	202.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	2149.6	70
120 min Winter	32.885	0.0	2443.4	126
180 min Winter	23.621	0.0	2632.4	182
240 min Winter	18.682	0.0	2776.9	238
360 min Winter	13.435	0.0	2994.9	344
480 min Winter	10.653	0.0	3167.2	392
600 min Winter	8.910	0.0	3310.7	466
720 min Winter	7.706	0.0	3436.8	544
960 min Winter	6.140	0.0	3650.6	698
1440 min Winter	4.483	0.0	3997.3	996
2160 min Winter	3.294	0.0	4406.4	1372
2880 min Winter	2.663	0.0	4751.5	1712
4320 min Winter	2.002	0.0	5356.3	2300
5760 min Winter	1.655	0.0	5903.7	3008
7200 min Winter	1.442	0.0	6430.5	3744
8640 min Winter	1.297	0.0	6943.7	4424
10080 min Winter	1.193	0.0	7451.9	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.425

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.109	4	8	1.109	8	12	1.109	12	16	1.098

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 23.300

Tank or Pond Structure

Invert Level (m) 22.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1981.6	0.401	2369.6	0.801	2773.7	1.200	3192.8
0.101	2077.1	0.501	2469.2	0.901	2877.3		
0.201	2173.6	0.601	2569.7	1.001	2981.8		
0.301	2271.1	0.701	2671.2	1.101	3087.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0300-5450-1000-5210
Design Head (m)	1.000
Design Flow (l/s)	54.5
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	300
Invert Level (m)	22.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	54.5
Flush-Flo™	0.443	51.9
Kick-Flo®	0.735	47.0
Mean Flow over Head Range	-	42.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.2	1.200	59.5	3.000	92.8	7.000	140.3
0.200	30.9	1.400	64.1	3.500	100.0	7.500	145.2
0.300	50.3	1.600	68.4	4.000	106.8	8.000	149.8
0.400	51.8	1.800	72.4	4.500	113.1	8.500	154.3
0.500	51.8	2.000	76.2	5.000	119.1	9.000	158.7
0.600	50.6	2.200	79.8	5.500	124.7	9.500	163.0
0.800	48.9	2.400	83.3	6.000	130.1		
1.000	54.5	2.600	86.6	6.500	135.3		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	26.001	0.101	7.8	116.0	O K
30 min Summer	26.029	0.129	11.9	149.1	O K
60 min Summer	26.056	0.156	16.0	181.1	O K
120 min Summer	26.076	0.176	19.2	205.1	O K
180 min Summer	26.086	0.186	20.7	217.7	O K
240 min Summer	26.092	0.192	21.6	225.0	O K
360 min Summer	26.095	0.195	22.1	229.1	O K
480 min Summer	26.094	0.194	21.9	228.2	O K
600 min Summer	26.092	0.192	21.6	225.0	O K
720 min Summer	26.089	0.189	21.2	220.8	O K
960 min Summer	26.081	0.181	20.1	211.8	O K
1440 min Summer	26.067	0.167	17.9	195.1	O K
2160 min Summer	26.051	0.151	15.3	175.5	O K
2880 min Summer	26.039	0.139	13.4	161.3	O K
4320 min Summer	26.023	0.123	10.9	141.9	O K
5760 min Summer	26.012	0.112	9.3	129.0	O K
7200 min Summer	26.004	0.104	8.2	119.5	O K
8640 min Summer	25.998	0.098	7.3	112.1	O K
10080 min Summer	25.993	0.093	6.6	106.2	O K
15 min Winter	26.013	0.113	9.4	129.5	O K
30 min Winter	26.044	0.144	14.1	166.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	106.4	28
30 min Summer	19.618	0.0	145.8	40
60 min Summer	12.728	0.0	201.6	64
120 min Summer	8.110	0.0	258.9	100
180 min Summer	6.206	0.0	298.2	132
240 min Summer	5.126	0.0	329.2	166
360 min Summer	3.877	0.0	374.3	232
480 min Summer	3.179	0.0	409.7	300
600 min Summer	2.725	0.0	439.4	364
720 min Summer	2.403	0.0	465.2	428
960 min Summer	1.972	0.0	508.9	552
1440 min Summer	1.492	0.0	576.8	800
2160 min Summer	1.128	0.0	663.2	1168
2880 min Summer	0.925	0.0	724.6	1532
4320 min Summer	0.700	0.0	818.7	2256
5760 min Summer	0.575	0.0	906.1	2992
7200 min Summer	0.492	0.0	969.4	3688
8640 min Summer	0.433	0.0	1021.9	4416
10080 min Summer	0.389	0.0	1066.2	5152
15 min Winter	29.494	0.0	120.7	28
30 min Winter	19.618	0.0	165.0	40

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	26.073	0.173	18.8	202.2	O K
120 min Winter	26.094	0.194	21.9	228.2	O K
180 min Winter	26.104	0.204	23.2	239.6	O K
240 min Winter	26.108	0.208	23.7	244.3	O K
360 min Winter	26.106	0.206	23.5	242.3	O K
480 min Winter	26.101	0.201	22.8	235.8	O K
600 min Winter	26.094	0.194	21.9	228.0	O K
720 min Winter	26.088	0.188	21.0	220.2	O K
960 min Winter	26.076	0.176	19.3	205.7	O K
1440 min Winter	26.057	0.157	16.3	182.9	O K
2160 min Winter	26.038	0.138	13.2	159.5	O K
2880 min Winter	26.025	0.125	11.2	143.9	O K
4320 min Winter	26.008	0.108	8.7	124.0	O K
5760 min Winter	25.998	0.098	7.3	111.6	O K
7200 min Winter	25.990	0.090	6.2	102.7	O K
8640 min Winter	25.984	0.084	5.6	95.8	O K
10080 min Winter	25.979	0.079	5.0	90.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	226.7	64
120 min Winter	8.110	0.0	290.9	104
180 min Winter	6.206	0.0	335.0	140
240 min Winter	5.126	0.0	369.7	176
360 min Winter	3.877	0.0	420.2	248
480 min Winter	3.179	0.0	460.0	318
600 min Winter	2.725	0.0	493.3	384
720 min Winter	2.403	0.0	522.2	448
960 min Winter	1.972	0.0	571.2	576
1440 min Winter	1.492	0.0	647.6	826
2160 min Winter	1.128	0.0	743.5	1196
2880 min Winter	0.925	0.0	812.4	1564
4320 min Winter	0.700	0.0	918.6	2292
5760 min Winter	0.575	0.0	1015.2	3000
7200 min Winter	0.492	0.0	1086.4	3752
8640 min Winter	0.433	0.0	1145.5	4480
10080 min Winter	0.389	0.0	1196.0	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.198

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.548	4	8	0.550	8	12	0.550	12	16	0.550

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 27.100

Tank or Pond Structure

Invert Level (m) 25.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1115.9	0.401	1359.2	0.801	1618.6	1.200	1893.3
0.101	1175.2	0.501	1422.5	0.901	1685.9		
0.201	1235.5	0.601	1486.9	1.001	1754.3		
0.301	1296.8	0.701	1552.2	1.101	1823.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0228-2710-0900-2710
Design Head (m)	0.900
Design Flow (l/s)	27.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	228
Invert Level (m)	25.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	27.1
Flush-Flo™	0.358	27.0
Kick-Flo®	0.679	23.7
Mean Flow over Head Range	-	22.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	31.1	3.000	48.3	7.000	72.9
0.200	22.7	1.400	33.5	3.500	52.1	7.500	75.4
0.300	26.8	1.600	35.7	4.000	55.6	8.000	77.8
0.400	26.9	1.800	37.8	4.500	58.8	8.500	80.2
0.500	26.4	2.000	39.8	5.000	61.9	9.000	82.4
0.600	25.4	2.200	41.6	5.500	64.9	9.500	84.2
0.800	25.6	2.400	43.4	6.000	67.7		
1.000	28.5	2.600	45.1	6.500	70.4		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	26.323	0.423	27.0	525.0	O K
30 min Summer	26.446	0.546	27.0	699.5	O K
60 min Summer	26.568	0.668	27.0	881.3	O K
120 min Summer	26.614	0.714	27.0	952.0	O K
180 min Summer	26.628	0.728	27.0	973.9	O K
240 min Summer	26.629	0.729	27.0	975.2	O K
360 min Summer	26.614	0.714	27.0	952.6	O K
480 min Summer	26.599	0.699	27.0	928.7	O K
600 min Summer	26.583	0.683	27.0	903.6	O K
720 min Summer	26.565	0.665	27.0	876.4	O K
960 min Summer	26.528	0.628	27.0	821.2	O K
1440 min Summer	26.459	0.559	27.0	718.2	O K
2160 min Summer	26.366	0.466	27.0	584.7	O K
2880 min Summer	26.290	0.390	27.0	480.0	O K
4320 min Summer	26.187	0.287	26.7	345.0	O K
5760 min Summer	26.133	0.233	26.1	275.7	O K
7200 min Summer	26.110	0.210	24.0	247.2	O K
8640 min Summer	26.096	0.196	22.1	229.7	O K
10080 min Summer	26.085	0.185	20.7	217.1	O K
15 min Winter	26.370	0.470	27.0	590.8	O K
30 min Winter	26.507	0.607	27.0	788.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	534.9	29
30 min Summer	90.183	0.0	722.1	43
60 min Summer	57.866	0.0	944.0	72
120 min Summer	32.885	0.0	1073.9	128
180 min Summer	23.621	0.0	1157.5	186
240 min Summer	18.682	0.0	1220.9	242
360 min Summer	13.435	0.0	1317.3	318
480 min Summer	10.653	0.0	1392.9	380
600 min Summer	8.910	0.0	1456.3	444
720 min Summer	7.706	0.0	1511.5	508
960 min Summer	6.140	0.0	1605.5	640
1440 min Summer	4.483	0.0	1757.2	904
2160 min Summer	3.294	0.0	1948.4	1284
2880 min Summer	2.663	0.0	2099.9	1648
4320 min Summer	2.002	0.0	2362.4	2336
5760 min Summer	1.655	0.0	2614.8	3000
7200 min Summer	1.442	0.0	2847.2	3688
8640 min Summer	1.297	0.0	3072.8	4416
10080 min Summer	1.193	0.0	3292.6	5144
15 min Winter	134.447	0.0	600.8	29
30 min Winter	90.183	0.0	810.1	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	26.641	0.741	27.0	994.3	O K
120 min Winter	26.693	0.793	27.0	1076.9	O K
180 min Winter	26.710	0.810	27.0	1105.7	O K
240 min Winter	26.714	0.814	27.0	1111.5	O K
360 min Winter	26.701	0.801	27.0	1090.5	O K
480 min Winter	26.679	0.779	27.0	1054.6	O K
600 min Winter	26.659	0.759	27.0	1023.3	O K
720 min Winter	26.637	0.737	27.0	988.9	O K
960 min Winter	26.589	0.689	27.0	912.9	O K
1440 min Winter	26.478	0.578	27.0	746.7	O K
2160 min Winter	26.332	0.432	27.0	537.8	O K
2880 min Winter	26.221	0.321	26.9	388.9	O K
4320 min Winter	26.117	0.217	24.8	255.9	O K
5760 min Winter	26.088	0.188	21.0	219.7	O K
7200 min Winter	26.071	0.171	18.4	199.2	O K
8640 min Winter	26.060	0.160	16.7	185.6	O K
10080 min Winter	26.052	0.152	15.4	175.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1058.2	72
120 min Winter	32.885	0.0	1203.6	126
180 min Winter	23.621	0.0	1297.2	182
240 min Winter	18.682	0.0	1368.3	238
360 min Winter	13.435	0.0	1476.3	346
480 min Winter	10.653	0.0	1560.9	398
600 min Winter	8.910	0.0	1631.9	472
720 min Winter	7.706	0.0	1693.7	548
960 min Winter	6.140	0.0	1798.9	704
1440 min Winter	4.483	0.0	1969.1	980
2160 min Winter	3.294	0.0	2182.9	1356
2880 min Winter	2.663	0.0	2352.9	1700
4320 min Winter	2.002	0.0	2647.9	2296
5760 min Winter	1.655	0.0	2929.1	3000
7200 min Winter	1.442	0.0	3189.6	3744
8640 min Winter	1.297	0.0	3442.7	4416
10080 min Winter	1.193	0.0	3690.1	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.198

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.548	4	8	0.550	8	12	0.550	12	16	0.550

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 27.100

Tank or Pond Structure

Invert Level (m) 25.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1115.9	0.401	1359.2	0.801	1618.6	1.200	1893.3
0.101	1175.2	0.501	1422.5	0.901	1685.9		
0.201	1235.5	0.601	1486.9	1.001	1754.3		
0.301	1296.8	0.701	1552.2	1.101	1823.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0228-2710-0900-2710
Design Head (m)	0.900
Design Flow (l/s)	27.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	228
Invert Level (m)	25.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	27.1
Flush-Flo™	0.358	27.0
Kick-Flo®	0.679	23.7
Mean Flow over Head Range	-	22.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	31.1	3.000	48.3	7.000	72.9
0.200	22.7	1.400	33.5	3.500	52.1	7.500	75.4
0.300	26.8	1.600	35.7	4.000	55.6	8.000	77.8
0.400	26.9	1.800	37.8	4.500	58.8	8.500	80.2
0.500	26.4	2.000	39.8	5.000	61.9	9.000	82.4
0.600	25.4	2.200	41.6	5.500	64.9	9.500	84.2
0.800	25.6	2.400	43.4	6.000	67.7		
1.000	28.5	2.600	45.1	6.500	70.4		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.289	0.089	6.5	147.6	O K
30 min Summer	15.315	0.115	10.3	191.4	O K
60 min Summer	15.341	0.141	14.7	236.3	O K
120 min Summer	15.362	0.162	18.3	272.4	O K
180 min Summer	15.372	0.172	20.2	290.4	O K
240 min Summer	15.379	0.179	21.4	302.4	O K
360 min Summer	15.385	0.185	22.5	313.1	O K
480 min Summer	15.387	0.187	22.8	316.6	O K
600 min Summer	15.387	0.187	22.8	316.4	O K
720 min Summer	15.386	0.186	22.6	314.1	O K
960 min Summer	15.382	0.182	21.9	306.8	O K
1440 min Summer	15.372	0.172	20.1	289.2	O K
2160 min Summer	15.358	0.158	17.7	265.4	O K
2880 min Summer	15.347	0.147	15.7	246.6	O K
4320 min Summer	15.332	0.132	13.0	219.6	O K
5760 min Summer	15.321	0.121	11.2	201.1	O K
7200 min Summer	15.313	0.113	9.9	186.9	O K
8640 min Summer	15.306	0.106	8.9	175.4	O K
10080 min Summer	15.301	0.101	8.1	166.5	O K
15 min Winter	15.300	0.100	8.0	164.9	O K
30 min Winter	15.328	0.128	12.5	213.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	123.9	29
30 min Summer	19.618	0.0	172.4	42
60 min Summer	12.728	0.0	246.7	68
120 min Summer	8.110	0.0	318.3	112
180 min Summer	6.206	0.0	367.4	140
240 min Summer	5.126	0.0	406.1	172
360 min Summer	3.877	0.0	462.4	240
480 min Summer	3.179	0.0	506.5	308
600 min Summer	2.725	0.0	543.5	374
720 min Summer	2.403	0.0	575.6	440
960 min Summer	1.972	0.0	629.7	568
1440 min Summer	1.492	0.0	713.4	818
2160 min Summer	1.128	0.0	827.0	1188
2880 min Summer	0.925	0.0	903.2	1556
4320 min Summer	0.700	0.0	1018.6	2292
5760 min Summer	0.575	0.0	1133.0	3008
7200 min Summer	0.492	0.0	1211.8	3744
8640 min Summer	0.433	0.0	1276.5	4488
10080 min Summer	0.389	0.0	1330.1	5152
15 min Winter	29.494	0.0	141.5	29
30 min Winter	19.618	0.0	196.1	41

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	15.357	0.157	17.5	263.9	O K
120 min Winter	15.380	0.180	21.6	304.1	O K
180 min Winter	15.390	0.190	23.4	322.0	O K
240 min Winter	15.396	0.196	24.3	332.4	O K
360 min Winter	15.399	0.199	24.8	337.0	O K
480 min Winter	15.397	0.197	24.6	334.3	O K
600 min Winter	15.394	0.194	24.0	328.4	O K
720 min Winter	15.390	0.190	23.3	321.2	O K
960 min Winter	15.381	0.181	21.8	306.1	O K
1440 min Winter	15.366	0.166	19.0	278.7	O K
2160 min Winter	15.348	0.148	15.8	247.4	O K
2880 min Winter	15.335	0.135	13.6	225.1	O K
4320 min Winter	15.318	0.118	10.7	195.5	O K
5760 min Winter	15.306	0.106	8.9	176.5	O K
7200 min Winter	15.298	0.098	7.8	162.5	O K
8640 min Winter	15.292	0.092	6.8	151.9	O K
10080 min Winter	15.287	0.087	6.2	143.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	278.1	66
120 min Winter	8.110	0.0	358.4	116
180 min Winter	6.206	0.0	413.4	146
240 min Winter	5.126	0.0	456.8	184
360 min Winter	3.877	0.0	519.9	256
480 min Winter	3.179	0.0	569.4	328
600 min Winter	2.725	0.0	610.9	396
720 min Winter	2.403	0.0	646.9	464
960 min Winter	1.972	0.0	707.7	596
1440 min Winter	1.492	0.0	801.9	850
2160 min Winter	1.128	0.0	927.6	1220
2880 min Winter	0.925	0.0	1013.2	1592
4320 min Winter	0.700	0.0	1143.7	2332
5760 min Winter	0.575	0.0	1269.9	3064
7200 min Winter	0.492	0.0	1358.4	3760
8640 min Winter	0.433	0.0	1431.5	4504
10080 min Winter	0.389	0.0	1492.8	5248

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.755

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.688	4	8	0.688	8	12	0.688	12	16	0.691

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Model Details

Storage is Online Cover Level (m) 16.400

Tank or Pond Structure

Invert Level (m) 15.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1613.4	0.401	1959.3	0.801	2321.2	1.200	2698.2
0.101	1698.4	0.501	2048.2	0.901	2414.2		
0.201	1784.3	0.601	2138.2	1.001	2508.2		
0.301	1871.3	0.701	2229.2	1.101	2603.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0245-3230-0900-3230
Design Head (m)	0.900
Design Flow (l/s)	32.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	245
Invert Level (m)	15.200
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	32.3
Flush-Flo™	0.380	32.3
Kick-Flo®	0.696	28.6
Mean Flow over Head Range	-	26.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	1.200	37.1	3.000	57.7	7.000	87.1
0.200	25.0	1.400	39.9	3.500	62.2	7.500	90.1
0.300	31.9	1.600	42.6	4.000	66.3	8.000	93.0
0.400	32.3	1.800	45.1	4.500	70.2	8.500	95.7
0.500	31.8	2.000	47.4	5.000	73.9	9.000	98.5
0.600	30.7	2.200	49.6	5.500	77.4	9.500	100.5
0.800	30.5	2.400	51.8	6.000	80.8		
1.000	34.0	2.600	53.8	6.500	84.0		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.573	0.373	32.3	661.8	O K
30 min Summer	15.684	0.484	32.3	880.7	O K
60 min Summer	15.794	0.594	32.3	1109.5	O K
120 min Summer	15.837	0.637	32.3	1202.6	O K
180 min Summer	15.852	0.652	32.3	1235.9	O K
240 min Summer	15.855	0.655	32.3	1243.0	O K
360 min Summer	15.846	0.646	32.3	1222.0	O K
480 min Summer	15.835	0.635	32.3	1197.9	O K
600 min Summer	15.823	0.623	32.3	1172.5	O K
720 min Summer	15.811	0.611	32.3	1145.8	O K
960 min Summer	15.784	0.584	32.3	1088.7	O K
1440 min Summer	15.730	0.530	32.3	975.2	O K
2160 min Summer	15.654	0.454	32.3	820.3	O K
2880 min Summer	15.590	0.390	32.3	695.0	O K
4320 min Summer	15.502	0.302	32.0	526.0	O K
5760 min Summer	15.451	0.251	31.3	431.4	O K
7200 min Summer	15.428	0.228	29.2	389.0	O K
8640 min Summer	15.413	0.213	27.0	362.0	O K
10080 min Summer	15.402	0.202	25.4	343.3	O K
15 min Winter	15.615	0.415	32.3	744.0	O K
30 min Winter	15.738	0.538	32.3	991.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	656.9	29
30 min Summer	90.183	0.0	890.0	43
60 min Summer	57.866	0.0	1176.0	72
120 min Summer	32.885	0.0	1338.3	128
180 min Summer	23.621	0.0	1442.9	186
240 min Summer	18.682	0.0	1522.2	242
360 min Summer	13.435	0.0	1642.6	322
480 min Summer	10.653	0.0	1736.9	380
600 min Summer	8.910	0.0	1816.0	440
720 min Summer	7.706	0.0	1884.7	506
960 min Summer	6.140	0.0	2001.6	640
1440 min Summer	4.483	0.0	2189.7	908
2160 min Summer	3.294	0.0	2437.4	1296
2880 min Summer	2.663	0.0	2626.5	1656
4320 min Summer	2.002	0.0	2951.8	2348
5760 min Summer	1.655	0.0	3274.6	3016
7200 min Summer	1.442	0.0	3565.1	3744
8640 min Summer	1.297	0.0	3846.4	4424
10080 min Summer	1.193	0.0	4118.7	5152
15 min Winter	134.447	0.0	739.0	29
30 min Winter	90.183	0.0	999.6	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	15.860	0.660	32.3	1252.2	O K
120 min Winter	15.910	0.710	32.3	1364.5	O K
180 min Winter	15.930	0.730	32.3	1409.1	O K
240 min Winter	15.937	0.737	32.3	1424.1	O K
360 min Winter	15.931	0.731	32.3	1411.5	O K
480 min Winter	15.914	0.714	32.3	1373.5	O K
600 min Winter	15.897	0.697	32.3	1334.8	O K
720 min Winter	15.879	0.679	32.3	1294.1	O K
960 min Winter	15.838	0.638	32.3	1204.8	O K
1440 min Winter	15.753	0.553	32.3	1023.0	O K
2160 min Winter	15.634	0.434	32.3	779.9	O K
2880 min Winter	15.539	0.339	32.2	596.6	O K
4320 min Winter	15.437	0.237	30.5	406.7	O K
5760 min Winter	15.406	0.206	25.9	350.2	O K
7200 min Winter	15.388	0.188	22.9	317.9	O K
8640 min Winter	15.376	0.176	20.8	296.2	O K
10080 min Winter	15.367	0.167	19.2	280.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1318.8	72
120 min Winter	32.885	0.0	1500.6	128
180 min Winter	23.621	0.0	1617.6	184
240 min Winter	18.682	0.0	1706.4	240
360 min Winter	13.435	0.0	1841.2	350
480 min Winter	10.653	0.0	1946.8	448
600 min Winter	8.910	0.0	2035.3	482
720 min Winter	7.706	0.0	2112.4	556
960 min Winter	6.140	0.0	2243.4	702
1440 min Winter	4.483	0.0	2454.4	984
2160 min Winter	3.294	0.0	2731.4	1372
2880 min Winter	2.663	0.0	2943.6	1716
4320 min Winter	2.002	0.0	3309.7	2336
5760 min Winter	1.655	0.0	3668.5	3056
7200 min Winter	1.442	0.0	3994.3	3752
8640 min Winter	1.297	0.0	4310.2	4488
10080 min Winter	1.193	0.0	4617.4	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.755

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.688	4	8	0.688	8	12	0.688	12	16	0.691

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Model Details

Storage is Online Cover Level (m) 16.400

Tank or Pond Structure

Invert Level (m) 15.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1613.4	0.401	1959.3	0.801	2321.2	1.200	2698.2
0.101	1698.4	0.501	2048.2	0.901	2414.2		
0.201	1784.3	0.601	2138.2	1.001	2508.2		
0.301	1871.3	0.701	2229.2	1.101	2603.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0245-3230-0900-3230
Design Head (m)	0.900
Design Flow (l/s)	32.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	245
Invert Level (m)	15.200
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	32.3
Flush-Flo™	0.380	32.3
Kick-Flo®	0.696	28.6
Mean Flow over Head Range	-	26.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	1.200	37.1	3.000	57.7	7.000	87.1
0.200	25.0	1.400	39.9	3.500	62.2	7.500	90.1
0.300	31.9	1.600	42.6	4.000	66.3	8.000	93.0
0.400	32.3	1.800	45.1	4.500	70.2	8.500	95.7
0.500	31.8	2.000	47.4	5.000	73.9	9.000	98.5
0.600	30.7	2.200	49.6	5.500	77.4	9.500	100.5
0.800	30.5	2.400	51.8	6.000	80.8		
1.000	34.0	2.600	53.8	6.500	84.0		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.822	0.122	15.1	77.0	O K
30 min Summer	19.855	0.155	15.3	99.3	O K
60 min Summer	19.883	0.183	15.4	118.3	O K
120 min Summer	19.897	0.197	15.5	128.1	O K
180 min Summer	19.899	0.199	15.5	129.7	O K
240 min Summer	19.897	0.197	15.5	128.2	O K
360 min Summer	19.886	0.186	15.4	120.6	O K
480 min Summer	19.874	0.174	15.4	112.3	O K
600 min Summer	19.862	0.162	15.4	104.0	O K
720 min Summer	19.850	0.150	15.3	95.8	O K
960 min Summer	19.828	0.128	15.2	80.8	O K
1440 min Summer	19.793	0.093	14.8	58.1	O K
2160 min Summer	19.765	0.065	12.9	40.1	O K
2880 min Summer	19.747	0.047	11.3	29.0	O K
4320 min Summer	19.726	0.026	9.1	15.9	O K
5760 min Summer	19.714	0.014	7.7	8.2	O K
7200 min Summer	19.705	0.005	6.8	3.0	O K
8640 min Summer	19.700	0.000	6.1	0.0	O K
10080 min Summer	19.700	0.000	5.5	0.0	O K
15 min Winter	19.838	0.138	15.2	87.9	O K
30 min Winter	19.876	0.176	15.4	113.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	95.1	26
30 min Summer	19.618	0.0	126.8	38
60 min Summer	12.728	0.0	164.4	62
120 min Summer	8.110	0.0	209.3	100
180 min Summer	6.206	0.0	240.7	134
240 min Summer	5.126	0.0	264.9	168
360 min Summer	3.877	0.0	300.2	236
480 min Summer	3.179	0.0	328.4	304
600 min Summer	2.725	0.0	352.0	370
720 min Summer	2.403	0.0	373.0	434
960 min Summer	1.972	0.0	407.8	558
1440 min Summer	1.492	0.0	463.1	792
2160 min Summer	1.128	0.0	525.1	1148
2880 min Summer	0.925	0.0	573.9	1508
4320 min Summer	0.700	0.0	651.7	2216
5760 min Summer	0.575	0.0	713.9	2944
7200 min Summer	0.492	0.0	764.2	3680
8640 min Summer	0.433	0.0	807.1	0
10080 min Summer	0.389	0.0	845.1	0
15 min Winter	29.494	0.0	106.5	27
30 min Winter	19.618	0.0	142.0	39

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.910	0.210	15.5	137.0	O K
120 min Winter	19.926	0.226	15.5	149.0	O K
180 min Winter	19.928	0.228	15.5	150.0	O K
240 min Winter	19.923	0.223	15.5	146.7	O K
360 min Winter	19.904	0.204	15.5	133.0	O K
480 min Winter	19.883	0.183	15.4	118.2	O K
600 min Winter	19.862	0.162	15.4	104.2	O K
720 min Winter	19.843	0.143	15.3	91.0	O K
960 min Winter	19.809	0.109	15.0	68.7	O K
1440 min Winter	19.771	0.071	13.4	43.8	O K
2160 min Winter	19.742	0.042	10.8	25.7	O K
2880 min Winter	19.726	0.026	9.1	15.8	O K
4320 min Winter	19.707	0.007	7.0	4.2	O K
5760 min Winter	19.700	0.000	5.9	0.0	O K
7200 min Winter	19.700	0.000	5.0	0.0	O K
8640 min Winter	19.700	0.000	4.4	0.0	O K
10080 min Winter	19.700	0.000	4.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	184.1	64
120 min Winter	8.110	0.0	234.9	108
180 min Winter	6.206	0.0	269.3	144
240 min Winter	5.126	0.0	296.7	182
360 min Winter	3.877	0.0	336.6	256
480 min Winter	3.179	0.0	368.2	328
600 min Winter	2.725	0.0	394.8	394
720 min Winter	2.403	0.0	417.4	458
960 min Winter	1.972	0.0	456.9	578
1440 min Winter	1.492	0.0	518.7	808
2160 min Winter	1.128	0.0	588.0	1164
2880 min Winter	0.925	0.0	642.7	1532
4320 min Winter	0.700	0.0	729.9	2252
5760 min Winter	0.575	0.0	799.6	0
7200 min Winter	0.492	0.0	856.2	0
8640 min Winter	0.433	0.0	904.0	0
10080 min Winter	0.389	0.0	946.6	0

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.725

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.424	4	8	0.424	8	12	0.424	12	16	0.453

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Model Details

Storage is Online Cover Level (m) 21.074

Tank or Pond Structure

Invert Level (m) 19.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	601.7	0.401	806.9	0.801	1027.7	1.201	1264.4
0.101	651.5	0.501	860.6	0.901	1085.4	1.301	1326.0
0.201	702.3	0.601	915.3	1.001	1144.1	1.374	1371.5
0.301	754.1	0.701	971.0	1.101	1203.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0177-1620-1100-1550
Design Head (m)	1.100
Design Flow (l/s)	16.2
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	177
Invert Level (m)	19.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	16.2
Flush-Flo™	0.323	15.5
Kick-Flo®	0.705	13.1
Mean Flow over Head Range	-	13.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3	1.200	16.9	3.000	26.1	7.000	39.3
0.200	14.9	1.400	18.2	3.500	28.2	7.500	40.7
0.300	15.5	1.600	19.4	4.000	30.0	8.000	42.0
0.400	15.4	1.800	20.5	4.500	31.8	8.500	43.2
0.500	15.1	2.000	21.5	5.000	33.4	9.000	44.4
0.600	14.5	2.200	22.5	5.500	35.0	9.500	45.6
0.800	13.9	2.400	23.5	6.000	36.5		
1.000	15.5	2.600	24.4	6.500	37.9		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	20.254	0.554	15.5	411.6	O K
30 min Summer	20.403	0.703	15.5	549.7	O K
60 min Summer	20.541	0.841	15.5	690.2	O K
120 min Summer	20.591	0.891	15.5	743.4	O K
180 min Summer	20.607	0.907	15.5	760.0	O K
240 min Summer	20.608	0.908	15.5	761.5	O K
360 min Summer	20.591	0.891	15.5	743.0	O K
480 min Summer	20.567	0.867	15.5	717.3	O K
600 min Summer	20.546	0.846	15.5	695.1	O K
720 min Summer	20.527	0.827	15.5	675.2	O K
960 min Summer	20.493	0.793	15.5	640.4	O K
1440 min Summer	20.435	0.735	15.5	581.1	O K
2160 min Summer	20.352	0.652	15.5	501.1	O K
2880 min Summer	20.262	0.562	15.5	418.5	O K
4320 min Summer	20.108	0.408	15.5	287.3	O K
5760 min Summer	19.993	0.293	15.5	197.7	O K
7200 min Summer	19.911	0.211	15.5	138.1	O K
8640 min Summer	19.856	0.156	15.3	99.9	O K
10080 min Summer	19.820	0.120	15.1	75.9	O K
15 min Winter	20.312	0.612	15.5	464.2	O K
30 min Winter	20.473	0.773	15.5	619.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	434.5	30
30 min Summer	90.183	0.0	583.0	44
60 min Summer	57.866	0.0	748.0	72
120 min Summer	32.885	0.0	850.9	130
180 min Summer	23.621	0.0	916.5	188
240 min Summer	18.682	0.0	966.4	244
360 min Summer	13.435	0.0	1042.5	360
480 min Summer	10.653	0.0	1102.0	420
600 min Summer	8.910	0.0	1152.5	482
720 min Summer	7.706	0.0	1196.2	544
960 min Summer	6.140	0.0	1270.7	678
1440 min Summer	4.483	0.0	1391.5	956
2160 min Summer	3.294	0.0	1533.5	1372
2880 min Summer	2.663	0.0	1653.4	1764
4320 min Summer	2.002	0.0	1864.3	2480
5760 min Summer	1.655	0.0	2054.8	3176
7200 min Summer	1.442	0.0	2238.0	3888
8640 min Summer	1.297	0.0	2416.8	4512
10080 min Summer	1.193	0.0	2593.8	5248
15 min Winter	134.447	0.0	486.5	30
30 min Winter	90.183	0.0	653.2	44

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	20.625	0.925	15.7	780.2	O K
120 min Winter	20.684	0.984	16.1	845.9	O K
180 min Winter	20.706	1.006	16.2	870.7	O K
240 min Winter	20.712	1.012	16.3	877.9	O K
360 min Winter	20.703	1.003	16.2	867.3	O K
480 min Winter	20.681	0.981	16.1	842.2	O K
600 min Winter	20.654	0.954	15.9	811.9	O K
720 min Winter	20.632	0.932	15.7	787.6	O K
960 min Winter	20.589	0.889	15.5	740.9	O K
1440 min Winter	20.506	0.806	15.5	653.3	O K
2160 min Winter	20.381	0.681	15.5	529.1	O K
2880 min Winter	20.235	0.535	15.5	394.7	O K
4320 min Winter	19.991	0.291	15.5	196.5	O K
5760 min Winter	19.843	0.143	15.3	91.0	O K
7200 min Winter	19.784	0.084	14.5	52.0	O K
8640 min Winter	19.767	0.067	13.1	41.2	O K
10080 min Winter	19.755	0.055	12.1	34.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	838.5	72
120 min Winter	32.885	0.0	952.8	128
180 min Winter	23.621	0.0	1026.1	184
240 min Winter	18.682	0.0	1082.5	240
360 min Winter	13.435	0.0	1167.5	352
480 min Winter	10.653	0.0	1234.8	460
600 min Winter	8.910	0.0	1290.7	546
720 min Winter	7.706	0.0	1339.5	574
960 min Winter	6.140	0.0	1422.9	730
1440 min Winter	4.483	0.0	1558.6	1036
2160 min Winter	3.294	0.0	1717.3	1484
2880 min Winter	2.663	0.0	1852.0	1884
4320 min Winter	2.002	0.0	2088.3	2560
5760 min Winter	1.655	0.0	2301.5	3176
7200 min Winter	1.442	0.0	2506.8	3712
8640 min Winter	1.297	0.0	2706.9	4416
10080 min Winter	1.193	0.0	2905.1	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.725

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.424	4	8	0.424	8	12	0.424	12	16	0.453

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Model Details

Storage is Online Cover Level (m) 21.074

Tank or Pond Structure

Invert Level (m) 19.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	601.7	0.401	806.9	0.801	1027.7	1.201	1264.4
0.101	651.5	0.501	860.6	0.901	1085.4	1.301	1326.0
0.201	702.3	0.601	915.3	1.001	1144.1	1.374	1371.5
0.301	754.1	0.701	971.0	1.101	1203.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0177-1620-1100-1550
Design Head (m)	1.100
Design Flow (l/s)	16.2
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	177
Invert Level (m)	19.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	16.2
Flush-Flo™	0.323	15.5
Kick-Flo®	0.705	13.1
Mean Flow over Head Range	-	13.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3	1.200	16.9	3.000	26.1	7.000	39.3
0.200	14.9	1.400	18.2	3.500	28.2	7.500	40.7
0.300	15.5	1.600	19.4	4.000	30.0	8.000	42.0
0.400	15.4	1.800	20.5	4.500	31.8	8.500	43.2
0.500	15.1	2.000	21.5	5.000	33.4	9.000	44.4
0.600	14.5	2.200	22.5	5.500	35.0	9.500	45.6
0.800	13.9	2.400	23.5	6.000	36.5		
1.000	15.5	2.600	24.4	6.500	37.9		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.353	0.103	8.0	115.0	O K
30 min Summer	18.382	0.132	12.2	147.7	O K
60 min Summer	18.408	0.158	16.4	179.1	O K
120 min Summer	18.428	0.178	19.6	202.7	O K
180 min Summer	18.438	0.188	21.0	215.0	O K
240 min Summer	18.444	0.194	21.9	221.9	O K
360 min Summer	18.447	0.197	22.3	225.6	O K
480 min Summer	18.446	0.196	22.1	224.3	O K
600 min Summer	18.443	0.193	21.7	220.9	O K
720 min Summer	18.440	0.190	21.2	216.5	O K
960 min Summer	18.432	0.182	20.1	207.2	O K
1440 min Summer	18.418	0.168	17.9	190.4	O K
2160 min Summer	18.401	0.151	15.3	170.8	O K
2880 min Summer	18.389	0.139	13.4	156.8	O K
4320 min Summer	18.373	0.123	10.9	137.8	O K
5760 min Summer	18.362	0.112	9.3	125.0	O K
7200 min Summer	18.354	0.104	8.2	115.8	O K
8640 min Summer	18.348	0.098	7.3	108.7	O K
10080 min Summer	18.343	0.093	6.6	102.8	O K
15 min Winter	18.365	0.115	9.7	128.4	O K
30 min Winter	18.396	0.146	14.5	164.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	106.5	28
30 min Summer	19.618	0.0	145.7	40
60 min Summer	12.728	0.0	200.7	64
120 min Summer	8.110	0.0	257.7	100
180 min Summer	6.206	0.0	296.8	132
240 min Summer	5.126	0.0	327.6	166
360 min Summer	3.877	0.0	372.4	232
480 min Summer	3.179	0.0	407.7	298
600 min Summer	2.725	0.0	437.2	364
720 min Summer	2.403	0.0	462.9	426
960 min Summer	1.972	0.0	506.3	552
1440 min Summer	1.492	0.0	573.9	798
2160 min Summer	1.128	0.0	659.3	1168
2880 min Summer	0.925	0.0	720.3	1532
4320 min Summer	0.700	0.0	814.2	2256
5760 min Summer	0.575	0.0	900.5	2992
7200 min Summer	0.492	0.0	963.5	3688
8640 min Summer	0.433	0.0	1015.8	4416
10080 min Summer	0.389	0.0	1060.0	5152
15 min Winter	29.494	0.0	120.7	28
30 min Winter	19.618	0.0	164.8	40

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.426	0.176	19.2	200.0	O K
120 min Winter	18.447	0.197	22.2	225.4	O K
180 min Winter	18.456	0.206	23.4	236.4	O K
240 min Winter	18.460	0.210	23.9	240.7	O K
360 min Winter	18.457	0.207	23.6	238.2	O K
480 min Winter	18.452	0.202	22.9	231.4	O K
600 min Winter	18.445	0.195	22.0	223.4	O K
720 min Winter	18.439	0.189	21.1	215.4	O K
960 min Winter	18.427	0.177	19.3	200.7	O K
1440 min Winter	18.407	0.157	16.2	178.0	O K
2160 min Winter	18.388	0.138	13.2	154.9	O K
2880 min Winter	18.375	0.125	11.2	139.5	O K
4320 min Winter	18.358	0.108	8.7	120.2	O K
5760 min Winter	18.347	0.097	7.2	108.0	O K
7200 min Winter	18.340	0.090	6.2	99.2	O K
8640 min Winter	18.334	0.084	5.5	92.6	O K
10080 min Winter	18.329	0.079	5.0	87.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	225.7	64
120 min Winter	8.110	0.0	289.6	102
180 min Winter	6.206	0.0	333.4	140
240 min Winter	5.126	0.0	367.9	176
360 min Winter	3.877	0.0	418.1	248
480 min Winter	3.179	0.0	457.6	316
600 min Winter	2.725	0.0	490.7	382
720 min Winter	2.403	0.0	519.5	448
960 min Winter	1.972	0.0	568.2	574
1440 min Winter	1.492	0.0	644.2	824
2160 min Winter	1.128	0.0	739.1	1192
2880 min Winter	0.925	0.0	807.6	1560
4320 min Winter	0.700	0.0	913.3	2296
5760 min Winter	0.575	0.0	1009.0	3008
7200 min Winter	0.492	0.0	1079.7	3744
8640 min Winter	0.433	0.0	1138.6	4496
10080 min Winter	0.389	0.0	1188.9	5152

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.184

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.546	4	8	0.546	8	12	0.546	12	16	0.546

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Model Details

Storage is Online Cover Level (m) 19.450

Tank or Pond Structure

Invert Level (m) 18.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1076.4	0.401	1361.2	0.801	1662.1	1.200	1978.3
0.101	1146.1	0.501	1434.9	0.901	1739.9		
0.201	1216.8	0.601	1509.7	1.001	1818.6		
0.301	1288.5	0.701	1585.4	1.101	1898.4		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0227-2690-0900-2690
Design Head (m)	0.900
Design Flow (l/s)	26.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	227
Invert Level (m)	18.250
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	26.9
Flush-Flo™	0.357	26.9
Kick-Flo®	0.682	23.6
Mean Flow over Head Range	-	22.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	30.9	3.000	48.0	7.000	72.4
0.200	22.6	1.400	33.2	3.500	51.7	7.500	74.9
0.300	26.7	1.600	35.4	4.000	55.2	8.000	77.3
0.400	26.8	1.800	37.5	4.500	58.4	8.500	79.6
0.500	26.3	2.000	39.5	5.000	61.5	9.000	81.8
0.600	25.3	2.200	41.3	5.500	64.4	9.500	83.6
0.800	25.4	2.400	43.1	6.000	67.2		
1.000	28.3	2.600	44.8	6.500	69.8		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.675	0.425	26.9	521.4	O K
30 min Summer	18.797	0.547	26.9	694.7	O K
60 min Summer	18.916	0.666	26.9	875.1	O K
120 min Summer	18.961	0.711	26.9	945.0	O K
180 min Summer	18.974	0.724	26.9	966.5	O K
240 min Summer	18.975	0.725	26.9	967.5	O K
360 min Summer	18.960	0.710	26.9	944.4	O K
480 min Summer	18.945	0.695	26.9	919.8	O K
600 min Summer	18.928	0.678	26.9	893.6	O K
720 min Summer	18.910	0.660	26.9	866.2	O K
960 min Summer	18.875	0.625	26.9	811.0	O K
1440 min Summer	18.806	0.556	26.9	708.3	O K
2160 min Summer	18.714	0.464	26.9	575.3	O K
2880 min Summer	18.639	0.389	26.9	471.1	O K
4320 min Summer	18.537	0.287	26.6	337.0	O K
5760 min Summer	18.482	0.232	26.0	268.6	O K
7200 min Summer	18.460	0.210	23.9	240.8	O K
8640 min Summer	18.445	0.195	22.0	223.5	O K
10080 min Summer	18.435	0.185	20.6	211.1	O K
15 min Winter	18.722	0.472	26.9	586.8	O K
30 min Winter	18.856	0.606	26.9	783.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	532.6	29
30 min Summer	90.183	0.0	718.6	43
60 min Summer	57.866	0.0	938.6	72
120 min Summer	32.885	0.0	1067.6	128
180 min Summer	23.621	0.0	1150.7	186
240 min Summer	18.682	0.0	1213.8	242
360 min Summer	13.435	0.0	1309.6	318
480 min Summer	10.653	0.0	1384.8	380
600 min Summer	8.910	0.0	1447.8	442
720 min Summer	7.706	0.0	1502.6	506
960 min Summer	6.140	0.0	1596.1	638
1440 min Summer	4.483	0.0	1746.9	904
2160 min Summer	3.294	0.0	1936.3	1284
2880 min Summer	2.663	0.0	2087.0	1648
4320 min Summer	2.002	0.0	2348.1	2336
5760 min Summer	1.655	0.0	2598.4	3000
7200 min Summer	1.442	0.0	2829.4	3688
8640 min Summer	1.297	0.0	3053.6	4416
10080 min Summer	1.193	0.0	3272.3	5144
15 min Winter	134.447	0.0	598.0	29
30 min Winter	90.183	0.0	806.2	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.987	0.737	26.9	987.6	O K
120 min Winter	19.037	0.787	26.9	1069.4	O K
180 min Winter	19.054	0.804	26.9	1097.8	O K
240 min Winter	19.058	0.808	26.9	1103.4	O K
360 min Winter	19.045	0.795	26.9	1082.1	O K
480 min Winter	19.023	0.773	26.9	1045.7	O K
600 min Winter	19.003	0.753	26.9	1013.9	O K
720 min Winter	18.982	0.732	26.9	979.1	O K
960 min Winter	18.933	0.683	26.9	901.6	O K
1440 min Winter	18.825	0.575	26.9	735.7	O K
2160 min Winter	18.680	0.430	26.9	527.9	O K
2880 min Winter	18.570	0.320	26.8	380.1	O K
4320 min Winter	18.466	0.216	24.7	249.2	O K
5760 min Winter	18.437	0.187	20.9	213.5	O K
7200 min Winter	18.421	0.171	18.4	193.6	O K
8640 min Winter	18.409	0.159	16.6	180.1	O K
10080 min Winter	18.401	0.151	15.3	170.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1052.0	72
120 min Winter	32.885	0.0	1196.5	126
180 min Winter	23.621	0.0	1289.6	182
240 min Winter	18.682	0.0	1360.3	238
360 min Winter	13.435	0.0	1467.6	346
480 min Winter	10.653	0.0	1551.7	400
600 min Winter	8.910	0.0	1622.3	472
720 min Winter	7.706	0.0	1683.7	550
960 min Winter	6.140	0.0	1788.3	704
1440 min Winter	4.483	0.0	1957.5	978
2160 min Winter	3.294	0.0	2169.4	1352
2880 min Winter	2.663	0.0	2338.4	1688
4320 min Winter	2.002	0.0	2631.7	2296
5760 min Winter	1.655	0.0	2910.7	3000
7200 min Winter	1.442	0.0	3169.6	3736
8640 min Winter	1.297	0.0	3421.1	4416
10080 min Winter	1.193	0.0	3667.2	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.184

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.546	4	8	0.546	8	12	0.546	12	16	0.546

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Model Details

Storage is Online Cover Level (m) 19.450

Tank or Pond Structure

Invert Level (m) 18.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1076.4	0.401	1361.2	0.801	1662.1	1.200	1978.3
0.101	1146.1	0.501	1434.9	0.901	1739.9		
0.201	1216.8	0.601	1509.7	1.001	1818.6		
0.301	1288.5	0.701	1585.4	1.101	1898.4		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0227-2690-0900-2690
Design Head (m)	0.900
Design Flow (l/s)	26.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	227
Invert Level (m)	18.250
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	26.9
Flush-Flo™	0.357	26.9
Kick-Flo®	0.682	23.6
Mean Flow over Head Range	-	22.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	30.9	3.000	48.0	7.000	72.4
0.200	22.6	1.400	33.2	3.500	51.7	7.500	74.9
0.300	26.7	1.600	35.4	4.000	55.2	8.000	77.3
0.400	26.8	1.800	37.5	4.500	58.4	8.500	79.6
0.500	26.3	2.000	39.5	5.000	61.5	9.000	81.8
0.600	25.3	2.200	41.3	5.500	64.4	9.500	83.6
0.800	25.4	2.400	43.1	6.000	67.2		
1.000	28.3	2.600	44.8	6.500	69.8		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.473	0.073	22.1	141.0	O K
30 min Summer	21.493	0.093	26.2	180.1	O K
60 min Summer	21.509	0.109	29.6	212.7	O K
120 min Summer	21.519	0.119	31.6	232.2	O K
180 min Summer	21.522	0.122	32.0	237.8	O K
240 min Summer	21.522	0.122	32.0	237.7	O K
360 min Summer	21.517	0.117	31.1	228.0	O K
480 min Summer	21.512	0.112	30.1	217.2	O K
600 min Summer	21.506	0.106	29.0	207.0	O K
720 min Summer	21.502	0.102	28.1	197.3	O K
960 min Summer	21.493	0.093	26.2	179.8	O K
1440 min Summer	21.478	0.078	23.3	151.6	O K
2160 min Summer	21.462	0.062	20.0	120.0	O K
2880 min Summer	21.451	0.051	17.7	97.2	O K
4320 min Summer	21.434	0.034	14.5	65.4	O K
5760 min Summer	21.423	0.023	12.5	44.3	O K
7200 min Summer	21.415	0.015	11.0	28.3	O K
8640 min Summer	21.409	0.009	10.0	16.6	O K
10080 min Summer	21.404	0.004	9.1	7.6	O K
15 min Winter	21.482	0.082	24.1	159.4	O K
30 min Winter	21.505	0.105	28.7	204.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	164.9	27
30 min Summer	19.618	0.0	219.7	38
60 min Summer	12.728	0.0	285.5	62
120 min Summer	8.110	0.0	363.9	94
180 min Summer	6.206	0.0	417.4	130
240 min Summer	5.126	0.0	460.6	164
360 min Summer	3.877	0.0	521.6	232
480 min Summer	3.179	0.0	570.7	298
600 min Summer	2.725	0.0	612.3	364
720 min Summer	2.403	0.0	647.8	430
960 min Summer	1.972	0.0	708.3	558
1440 min Summer	1.492	0.0	804.2	808
2160 min Summer	1.128	0.0	912.0	1176
2880 min Summer	0.925	0.0	997.4	1540
4320 min Summer	0.700	0.0	1132.1	2260
5760 min Summer	0.575	0.0	1239.6	3000
7200 min Summer	0.492	0.0	1328.1	3744
8640 min Summer	0.433	0.0	1401.9	4416
10080 min Summer	0.389	0.0	1467.9	5152
15 min Winter	29.494	0.0	184.7	27
30 min Winter	19.618	0.0	246.0	38

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	21.524	0.124	32.5	242.5	O K
120 min Winter	21.535	0.135	34.4	263.5	O K
180 min Winter	21.537	0.137	34.7	267.2	O K
240 min Winter	21.535	0.135	34.4	263.9	O K
360 min Winter	21.526	0.126	32.8	246.7	O K
480 min Winter	21.517	0.117	31.2	228.4	O K
600 min Winter	21.509	0.109	29.5	211.5	O K
720 min Winter	21.501	0.101	28.0	197.0	O K
960 min Winter	21.489	0.089	25.4	172.0	O K
1440 min Winter	21.470	0.070	21.5	134.4	O K
2160 min Winter	21.450	0.050	17.5	96.2	O K
2880 min Winter	21.437	0.037	15.0	70.2	O K
4320 min Winter	21.419	0.019	11.8	36.6	O K
5760 min Winter	21.408	0.008	9.9	15.3	O K
7200 min Winter	21.401	0.001	8.7	1.0	O K
8640 min Winter	21.400	0.000	7.7	0.0	O K
10080 min Winter	21.400	0.000	6.9	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	319.0	62
120 min Winter	8.110	0.0	407.1	100
180 min Winter	6.206	0.0	467.7	138
240 min Winter	5.126	0.0	515.7	174
360 min Winter	3.877	0.0	585.0	248
480 min Winter	3.179	0.0	639.8	316
600 min Winter	2.725	0.0	685.3	386
720 min Winter	2.403	0.0	724.9	452
960 min Winter	1.972	0.0	793.8	582
1440 min Winter	1.492	0.0	901.2	836
2160 min Winter	1.128	0.0	1021.0	1216
2880 min Winter	0.925	0.0	1116.7	1584
4320 min Winter	0.700	0.0	1268.0	2304
5760 min Winter	0.575	0.0	1388.6	3008
7200 min Winter	0.492	0.0	1488.1	3680
8640 min Winter	0.433	0.0	1571.1	0
10080 min Winter	0.389	0.0	1645.1	0

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.998

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.750	4	8	0.750	8	12	0.750	12	16	0.748

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Model Details

Storage is Online Cover Level (m) 22.400

Tank or Pond Structure

Invert Level (m) 21.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1904.7	0.301	2137.6	0.601	2379.6	0.901	2630.6
0.101	1981.3	0.401	2217.3	0.701	2462.3	1.000	2715.5
0.201	2058.9	0.501	2297.9	0.801	2546.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0269-4140-1000-4040
Design Head (m)	1.000
Design Flow (l/s)	41.4
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	269
Invert Level (m)	21.300
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	41.4
Flush-Flo™	0.411	40.3
Kick-Flo®	0.737	35.8
Mean Flow over Head Range	-	33.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.2	3.000	70.4	7.000	106.3
0.200	27.7	1.400	48.7	3.500	75.9	7.500	110.0
0.300	39.6	1.600	51.9	4.000	80.9	8.000	113.5
0.400	40.3	1.800	55.0	4.500	85.7	8.500	116.9
0.500	40.0	2.000	57.8	5.000	90.2	9.000	120.2
0.600	39.0	2.200	60.6	5.500	94.5	9.500	123.5
0.800	37.2	2.400	63.2	6.000	98.6		
1.000	41.4	2.600	65.7	6.500	102.6		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.746	0.346	40.3	704.2	O K
30 min Summer	21.851	0.451	40.3	936.7	O K
60 min Summer	21.953	0.553	40.3	1171.9	O K
120 min Summer	21.984	0.584	40.3	1246.2	O K
180 min Summer	21.989	0.589	40.3	1256.5	O K
240 min Summer	21.982	0.582	40.3	1239.5	O K
360 min Summer	21.959	0.559	40.3	1186.4	O K
480 min Summer	21.939	0.539	40.3	1138.3	O K
600 min Summer	21.919	0.519	40.3	1092.6	O K
720 min Summer	21.899	0.499	40.3	1048.0	O K
960 min Summer	21.862	0.462	40.3	963.2	O K
1440 min Summer	21.796	0.396	40.3	814.8	O K
2160 min Summer	21.714	0.314	40.3	636.0	O K
2880 min Summer	21.652	0.252	40.1	504.6	O K
4320 min Summer	21.575	0.175	39.1	345.6	O K
5760 min Summer	21.542	0.142	35.6	278.9	O K
7200 min Summer	21.523	0.123	32.2	239.1	O K
8640 min Summer	21.510	0.110	29.7	213.6	O K
10080 min Summer	21.500	0.100	27.8	194.9	O K
15 min Winter	21.787	0.387	40.3	793.9	O K
30 min Winter	21.904	0.504	40.3	1058.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	754.8	29
30 min Summer	90.183	0.0	1012.6	43
60 min Summer	57.866	0.0	1299.4	72
120 min Summer	32.885	0.0	1478.1	128
180 min Summer	23.621	0.0	1592.1	184
240 min Summer	18.682	0.0	1679.7	240
360 min Summer	13.435	0.0	1811.8	298
480 min Summer	10.653	0.0	1914.9	358
600 min Summer	8.910	0.0	2002.8	422
720 min Summer	7.706	0.0	2077.9	490
960 min Summer	6.140	0.0	2207.3	624
1440 min Summer	4.483	0.0	2418.2	888
2160 min Summer	3.294	0.0	2665.1	1264
2880 min Summer	2.663	0.0	2873.5	1620
4320 min Summer	2.002	0.0	3240.0	2300
5760 min Summer	1.655	0.0	3570.4	3000
7200 min Summer	1.442	0.0	3889.9	3744
8640 min Summer	1.297	0.0	4199.9	4416
10080 min Summer	1.193	0.0	4507.2	5152
15 min Winter	134.447	0.0	845.3	29
30 min Winter	90.183	0.0	1134.7	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	22.019	0.619	40.3	1329.2	O K
120 min Winter	22.059	0.659	40.3	1425.6	O K
180 min Winter	22.069	0.669	40.3	1449.7	O K
240 min Winter	22.067	0.667	40.3	1443.5	O K
360 min Winter	22.044	0.644	40.3	1388.9	O K
480 min Winter	22.014	0.614	40.3	1317.4	O K
600 min Winter	21.988	0.588	40.3	1254.1	O K
720 min Winter	21.960	0.560	40.3	1189.3	O K
960 min Winter	21.905	0.505	40.3	1060.8	O K
1440 min Winter	21.803	0.403	40.3	829.5	O K
2160 min Winter	21.678	0.278	40.3	559.8	O K
2880 min Winter	21.594	0.194	39.5	384.8	O K
4320 min Winter	21.531	0.131	33.7	255.0	O K
5760 min Winter	21.503	0.103	28.4	200.9	O K
7200 min Winter	21.487	0.087	25.0	168.0	O K
8640 min Winter	21.475	0.075	22.6	145.0	O K
10080 min Winter	21.467	0.067	20.9	128.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1456.1	70
120 min Winter	32.885	0.0	1655.3	126
180 min Winter	23.621	0.0	1783.4	182
240 min Winter	18.682	0.0	1880.5	238
360 min Winter	13.435	0.0	2028.8	344
480 min Winter	10.653	0.0	2145.7	390
600 min Winter	8.910	0.0	2242.3	462
720 min Winter	7.706	0.0	2328.1	536
960 min Winter	6.140	0.0	2473.0	682
1440 min Winter	4.483	0.0	2707.8	954
2160 min Winter	3.294	0.0	2986.2	1324
2880 min Winter	2.663	0.0	3218.5	1648
4320 min Winter	2.002	0.0	3628.7	2304
5760 min Winter	1.655	0.0	3999.1	3008
7200 min Winter	1.442	0.0	4356.1	3752
8640 min Winter	1.297	0.0	4704.0	4424
10080 min Winter	1.193	0.0	5048.1	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.998

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.750	4	8	0.750	8	12	0.750	12	16	0.748

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Model Details

Storage is Online Cover Level (m) 22.400

Tank or Pond Structure

Invert Level (m) 21.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1904.7	0.301	2137.6	0.601	2379.6	0.901	2630.6
0.101	1981.3	0.401	2217.3	0.701	2462.3	1.000	2715.5
0.201	2058.9	0.501	2297.9	0.801	2546.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0269-4140-1000-4040
Design Head (m)	1.000
Design Flow (l/s)	41.4
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	269
Invert Level (m)	21.300
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	41.4
Flush-Flo™	0.411	40.3
Kick-Flo®	0.737	35.8
Mean Flow over Head Range	-	33.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.2	3.000	70.4	7.000	106.3
0.200	27.7	1.400	48.7	3.500	75.9	7.500	110.0
0.300	39.6	1.600	51.9	4.000	80.9	8.000	113.5
0.400	40.3	1.800	55.0	4.500	85.7	8.500	116.9
0.500	40.0	2.000	57.8	5.000	90.2	9.000	120.2
0.600	39.0	2.200	60.6	5.500	94.5	9.500	123.5
0.800	37.2	2.400	63.2	6.000	98.6		
1.000	41.4	2.600	65.7	6.500	102.6		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.800	0.100	10.0	287.4	O K
30 min Summer	18.830	0.130	16.2	374.4	O K
60 min Summer	18.860	0.160	23.7	465.6	O K
120 min Summer	18.886	0.186	30.7	543.4	O K
180 min Summer	18.898	0.198	34.1	579.3	O K
240 min Summer	18.906	0.206	36.6	604.7	O K
360 min Summer	18.914	0.214	38.9	630.2	O K
480 min Summer	18.918	0.218	40.1	641.5	O K
600 min Summer	18.919	0.219	40.4	644.9	O K
720 min Summer	18.919	0.219	40.2	643.7	O K
960 min Summer	18.916	0.216	39.3	634.4	O K
1440 min Summer	18.907	0.207	36.7	606.4	O K
2160 min Summer	18.893	0.193	32.7	563.7	O K
2880 min Summer	18.881	0.181	29.3	528.0	O K
4320 min Summer	18.863	0.163	24.5	474.7	O K
5760 min Summer	18.850	0.150	21.2	436.5	O K
7200 min Summer	18.841	0.141	18.8	407.7	O K
8640 min Summer	18.833	0.133	16.9	383.9	O K
10080 min Summer	18.826	0.126	15.4	364.2	O K
15 min Winter	18.812	0.112	12.3	321.3	O K
30 min Winter	18.844	0.144	19.7	418.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	226.2	30
30 min Summer	19.618	0.0	318.3	43
60 min Summer	12.728	0.0	467.9	68
120 min Summer	8.110	0.0	606.0	120
180 min Summer	6.206	0.0	700.7	148
240 min Summer	5.126	0.0	775.3	178
360 min Summer	3.877	0.0	883.7	244
480 min Summer	3.179	0.0	968.8	312
600 min Summer	2.725	0.0	1039.9	378
720 min Summer	2.403	0.0	1101.5	444
960 min Summer	1.972	0.0	1205.4	574
1440 min Summer	1.492	0.0	1364.9	826
2160 min Summer	1.128	0.0	1593.0	1196
2880 min Summer	0.925	0.0	1739.3	1564
4320 min Summer	0.700	0.0	1958.9	2296
5760 min Summer	0.575	0.0	2187.8	3008
7200 min Summer	0.492	0.0	2339.1	3752
8640 min Summer	0.433	0.0	2462.9	4496
10080 min Summer	0.389	0.0	2563.7	5240
15 min Winter	29.494	0.0	259.5	29
30 min Winter	19.618	0.0	363.5	42

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.878	0.178	28.6	519.8	O K
120 min Winter	18.907	0.207	36.7	606.5	O K
180 min Winter	18.919	0.219	40.2	643.3	O K
240 min Winter	18.926	0.226	42.4	667.2	O K
360 min Winter	18.932	0.232	44.1	683.1	O K
480 min Winter	18.932	0.232	44.1	683.1	O K
600 min Winter	18.929	0.229	43.3	675.9	O K
720 min Winter	18.926	0.226	42.3	665.4	O K
960 min Winter	18.918	0.218	39.9	640.8	O K
1440 min Winter	18.902	0.202	35.4	592.3	O K
2160 min Winter	18.882	0.182	29.7	532.9	O K
2880 min Winter	18.868	0.168	25.7	488.4	O K
4320 min Winter	18.847	0.147	20.4	427.7	O K
5760 min Winter	18.834	0.134	17.1	387.4	O K
7200 min Winter	18.824	0.124	14.9	357.9	O K
8640 min Winter	18.816	0.116	13.2	334.7	O K
10080 min Winter	18.810	0.110	11.9	316.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	528.5	68
120 min Winter	8.110	0.0	683.3	118
180 min Winter	6.206	0.0	789.6	150
240 min Winter	5.126	0.0	873.3	186
360 min Winter	3.877	0.0	994.8	260
480 min Winter	3.179	0.0	1090.3	332
600 min Winter	2.725	0.0	1170.1	402
720 min Winter	2.403	0.0	1239.3	470
960 min Winter	1.972	0.0	1356.1	604
1440 min Winter	1.492	0.0	1535.8	860
2160 min Winter	1.128	0.0	1787.5	1240
2880 min Winter	0.925	0.0	1952.0	1612
4320 min Winter	0.700	0.0	2200.6	2344
5760 min Winter	0.575	0.0	2452.5	3064
7200 min Winter	0.492	0.0	2622.8	3824
8640 min Winter	0.433	0.0	2762.6	4504
10080 min Winter	0.389	0.0	2878.5	5256

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.330

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.332	4	8	1.332	8	12	1.332	12	16	1.334

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Model Details

Storage is Online Cover Level (m) 19.900

Tank or Pond Structure

Invert Level (m) 18.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2816.2	0.401	3284.4	0.801	3768.6	1.200	4267.6
0.101	2931.7	0.501	3404.0	0.901	3892.2		
0.201	3048.3	0.601	3524.5	1.001	4016.7		
0.301	3165.8	0.701	3646.1	1.101	4142.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0342-7080-0900-7080
Design Head (m)	0.900
Design Flow (l/s)	70.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	342
Invert Level (m)	18.700
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	70.8
Flush-Flo™	0.486	70.8
Kick-Flo®	0.758	65.1
Mean Flow over Head Range	-	54.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.0	1.200	81.4	3.000	127.0	7.000	192.3
0.200	34.7	1.400	87.7	3.500	137.0	7.500	198.9
0.300	63.2	1.600	93.6	4.000	146.2	8.000	205.3
0.400	70.1	1.800	99.1	4.500	154.9	8.500	211.5
0.500	70.8	2.000	104.3	5.000	163.1	9.000	217.6
0.600	69.8	2.200	109.2	5.500	170.9	9.500	221.5
0.800	66.9	2.400	114.0	6.000	178.3		
1.000	74.5	2.600	118.5	6.500	185.4		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.118	0.418	70.4	1278.3	O K
30 min Summer	19.242	0.542	70.8	1696.6	O K
60 min Summer	19.365	0.665	70.8	2131.6	O K
120 min Summer	19.412	0.712	70.8	2300.4	O K
180 min Summer	19.426	0.726	70.8	2353.0	O K
240 min Summer	19.426	0.726	70.8	2354.3	O K
360 min Summer	19.415	0.715	70.8	2313.0	O K
480 min Summer	19.403	0.703	70.8	2269.3	O K
600 min Summer	19.390	0.690	70.8	2220.9	O K
720 min Summer	19.375	0.675	70.8	2167.4	O K
960 min Summer	19.343	0.643	70.8	2052.5	O K
1440 min Summer	19.279	0.579	70.8	1824.3	O K
2160 min Summer	19.191	0.491	70.8	1524.0	O K
2880 min Summer	19.123	0.423	70.4	1295.4	O K
4320 min Summer	19.036	0.336	68.5	1013.0	O K
5760 min Summer	18.998	0.298	62.8	890.9	O K
7200 min Summer	18.975	0.275	56.8	819.1	O K
8640 min Summer	18.960	0.260	52.3	770.4	O K
10080 min Summer	18.949	0.249	49.1	735.4	O K
15 min Winter	19.165	0.465	70.8	1436.2	O K
30 min Winter	19.303	0.603	70.8	1910.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	1251.5	29
30 min Summer	90.183	0.0	1702.1	43
60 min Summer	57.866	0.0	2264.5	72
120 min Summer	32.885	0.0	2578.4	128
180 min Summer	23.621	0.0	2780.5	184
240 min Summer	18.682	0.0	2933.7	240
360 min Summer	13.435	0.0	3166.4	298
480 min Summer	10.653	0.0	3348.7	360
600 min Summer	8.910	0.0	3501.3	424
720 min Summer	7.706	0.0	3634.1	492
960 min Summer	6.140	0.0	3859.6	626
1440 min Summer	4.483	0.0	4221.1	890
2160 min Summer	3.294	0.0	4708.1	1264
2880 min Summer	2.663	0.0	5072.6	1620
4320 min Summer	2.002	0.0	5696.3	2300
5760 min Summer	1.655	0.0	6330.6	3000
7200 min Summer	1.442	0.0	6891.4	3744
8640 min Summer	1.297	0.0	7433.5	4424
10080 min Summer	1.193	0.0	7955.7	5152
15 min Winter	134.447	0.0	1410.2	29
30 min Winter	90.183	0.0	1914.1	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.441	0.741	70.8	2407.6	O K
120 min Winter	19.495	0.795	70.8	2610.0	O K
180 min Winter	19.514	0.814	70.8	2680.4	O K
240 min Winter	19.517	0.817	70.8	2694.1	O K
360 min Winter	19.504	0.804	70.8	2642.4	O K
480 min Winter	19.484	0.784	70.8	2569.9	O K
600 min Winter	19.465	0.765	70.8	2497.7	O K
720 min Winter	19.442	0.742	70.8	2412.0	O K
960 min Winter	19.391	0.691	70.8	2224.7	O K
1440 min Winter	19.288	0.588	70.8	1856.4	O K
2160 min Winter	19.154	0.454	70.7	1398.8	O K
2880 min Winter	19.061	0.361	69.3	1090.5	O K
4320 min Winter	18.985	0.285	59.4	849.7	O K
5760 min Winter	18.953	0.253	50.2	749.0	O K
7200 min Winter	18.933	0.233	44.4	686.1	O K
8640 min Winter	18.918	0.218	40.1	642.4	O K
10080 min Winter	18.908	0.208	37.0	610.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	2540.8	70
120 min Winter	32.885	0.0	2892.3	126
180 min Winter	23.621	0.0	3118.6	182
240 min Winter	18.682	0.0	3290.2	238
360 min Winter	13.435	0.0	3550.8	342
480 min Winter	10.653	0.0	3754.9	388
600 min Winter	8.910	0.0	3925.9	464
720 min Winter	7.706	0.0	4074.7	540
960 min Winter	6.140	0.0	4327.7	684
1440 min Winter	4.483	0.0	4734.5	956
2160 min Winter	3.294	0.0	5276.8	1328
2880 min Winter	2.663	0.0	5685.9	1652
4320 min Winter	2.002	0.0	6388.7	2332
5760 min Winter	1.655	0.0	7092.8	3056
7200 min Winter	1.442	0.0	7721.8	3752
8640 min Winter	1.297	0.0	8330.8	4496
10080 min Winter	1.193	0.0	8920.9	5240

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.330

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.332	4	8	1.332	8	12	1.332	12	16	1.334

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Model Details

Storage is Online Cover Level (m) 19.900

Tank or Pond Structure

Invert Level (m) 18.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2816.2	0.401	3284.4	0.801	3768.6	1.200	4267.6
0.101	2931.7	0.501	3404.0	0.901	3892.2		
0.201	3048.3	0.601	3524.5	1.001	4016.7		
0.301	3165.8	0.701	3646.1	1.101	4142.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0342-7080-0900-7080
Design Head (m)	0.900
Design Flow (l/s)	70.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	342
Invert Level (m)	18.700
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	70.8
Flush-Flo™	0.486	70.8
Kick-Flo®	0.758	65.1
Mean Flow over Head Range	-	54.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.0	1.200	81.4	3.000	127.0	7.000	192.3
0.200	34.7	1.400	87.7	3.500	137.0	7.500	198.9
0.300	63.2	1.600	93.6	4.000	146.2	8.000	205.3
0.400	70.1	1.800	99.1	4.500	154.9	8.500	211.5
0.500	70.8	2.000	104.3	5.000	163.1	9.000	217.6
0.600	69.8	2.200	109.2	5.500	170.9	9.500	221.5
0.800	66.9	2.400	114.0	6.000	178.3		
1.000	74.5	2.600	118.5	6.500	185.4		

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Cascade Summary of Results for Basin I.srcx

	Upstream Structures	Outflow To	Overflow To
	Basin J.srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	20.593	0.093	6.8	87.6	O K
30 min Summer	20.620	0.120	10.7	114.7	O K
60 min Summer	20.650	0.150	15.6	144.8	O K
120 min Summer	20.682	0.182	20.8	176.8	O K
180 min Summer	20.694	0.194	22.7	189.5	O K
240 min Summer	20.702	0.202	23.8	197.2	O K
360 min Summer	20.709	0.209	24.8	204.4	O K
480 min Summer	20.710	0.210	24.9	205.5	O K
600 min Summer	20.708	0.208	24.6	203.5	O K
720 min Summer	20.704	0.204	24.2	199.9	O K
960 min Summer	20.696	0.196	22.9	191.1	O K
1440 min Summer	20.680	0.180	20.5	174.5	O K
2160 min Summer	20.661	0.161	17.4	155.6	O K
2880 min Summer	20.648	0.148	15.2	142.1	O K
4320 min Summer	20.630	0.130	12.2	124.1	O K
5760 min Summer	20.618	0.118	10.3	112.4	O K
7200 min Summer	20.609	0.109	9.1	103.7	O K
8640 min Summer	20.602	0.102	8.1	97.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	119.8	69
30 min Summer	19.618	0.0	163.3	72
60 min Summer	12.728	0.0	222.5	90
120 min Summer	8.110	0.0	285.3	126
180 min Summer	6.206	0.0	328.3	164
240 min Summer	5.126	0.0	362.2	192
360 min Summer	3.877	0.0	411.5	252
480 min Summer	3.179	0.0	450.3	314
600 min Summer	2.725	0.0	482.8	376
720 min Summer	2.403	0.0	511.1	440
960 min Summer	1.972	0.0	558.9	564
1440 min Summer	1.492	0.0	633.5	808
2160 min Summer	1.128	0.0	726.1	1172
2880 min Summer	0.925	0.0	793.3	1532
4320 min Summer	0.700	0.0	896.9	2256
5760 min Summer	0.575	0.0	990.8	2992
7200 min Summer	0.492	0.0	1060.2	3712
8640 min Summer	0.433	0.0	1117.8	4424

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Cascade Summary of Results for Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	20.597	0.097	7.4	91.8	O K
15 min Winter	20.603	0.103	8.1	97.6	O K
30 min Winter	20.633	0.133	12.7	127.0	O K
60 min Winter	20.664	0.164	17.9	158.9	O K
120 min Winter	20.698	0.198	23.3	193.8	O K
180 min Winter	20.714	0.214	25.5	210.1	O K
240 min Winter	20.721	0.221	26.4	217.4	O K
360 min Winter	20.723	0.223	26.7	219.9	O K
480 min Winter	20.719	0.219	26.1	214.9	O K
600 min Winter	20.711	0.211	25.1	207.3	O K
720 min Winter	20.704	0.204	24.1	199.3	O K
960 min Winter	20.689	0.189	22.0	184.5	O K
1440 min Winter	20.667	0.167	18.4	161.9	O K
2160 min Winter	20.645	0.145	14.7	139.7	O K
2880 min Winter	20.631	0.131	12.5	125.4	O K
4320 min Winter	20.613	0.113	9.6	107.5	O K
5760 min Winter	20.602	0.102	8.0	96.3	O K
7200 min Winter	20.594	0.094	6.9	88.5	O K
8640 min Winter	20.587	0.087	6.0	82.5	O K
10080 min Winter	20.583	0.083	5.5	77.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.389	0.0	1166.7	5152
15 min Winter	29.494	0.0	135.7	67
30 min Winter	19.618	0.0	184.4	73
60 min Winter	12.728	0.0	250.0	92
120 min Winter	8.110	0.0	320.3	128
180 min Winter	6.206	0.0	368.5	170
240 min Winter	5.126	0.0	406.5	196
360 min Winter	3.877	0.0	461.8	262
480 min Winter	3.179	0.0	505.3	328
600 min Winter	2.725	0.0	541.7	392
720 min Winter	2.403	0.0	573.4	456
960 min Winter	1.972	0.0	627.1	582
1440 min Winter	1.492	0.0	710.9	828
2160 min Winter	1.128	0.0	813.8	1192
2880 min Winter	0.925	0.0	889.3	1560
4320 min Winter	0.700	0.0	1006.0	2296
5760 min Winter	0.575	0.0	1110.0	3000
7200 min Winter	0.492	0.0	1187.9	3712
8640 min Winter	0.433	0.0	1252.8	4488
10080 min Winter	0.389	0.0	1308.5	5144

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Cascade Rainfall Details for Basin I.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.011

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.501	4	8	0.510

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Cascade Model Details for Basin I.srcx

Storage is Online Cover Level (m) 21.700

Tank or Pond Structure

Invert Level (m) 20.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	918.6	0.401	1160.9	0.801	1419.2	1.200	1692.9
0.101	977.6	0.501	1224.0	0.901	1486.3		
0.201	1037.7	0.601	1288.1	1.001	1554.4		
0.301	1098.8	0.701	1353.1	1.101	1623.5		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0234-2960-0900-2870
Design Head (m)	0.900
Design Flow (l/s)	29.6
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	234
Invert Level (m)	20.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	29.6
Flush-Flo™	0.360	28.7
Kick-Flo®	0.653	25.4
Mean Flow over Head Range	-	23.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	34.0	3.000	52.8	7.000	79.7
0.200	23.6	1.400	36.6	3.500	56.9	7.500	82.5
0.300	28.5	1.600	39.0	4.000	60.7	8.000	85.1
0.400	28.6	1.800	41.3	4.500	64.3	8.500	87.7
0.500	28.0	2.000	43.4	5.000	67.7	9.000	90.1
0.600	26.7	2.200	45.5	5.500	70.9	9.500	92.1
0.800	28.0	2.400	47.4	6.000	74.0		
1.000	31.1	2.600	49.3	6.500	76.9		

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Cascade Summary of Results for Basin I.srcx

Upstream Structures	Outflow To	Overflow To
Basin J.srcx	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	20.792	0.292	28.4	293.8	O K
30 min Summer	20.959	0.459	28.7	484.2	O K
60 min Summer	21.137	0.637	28.7	707.3	O K
120 min Summer	21.204	0.704	28.7	797.1	O K
180 min Summer	21.227	0.727	28.7	827.9	O K
240 min Summer	21.236	0.736	28.7	841.4	O K
360 min Summer	21.245	0.745	28.7	853.6	O K
480 min Summer	21.247	0.747	28.7	855.8	O K
600 min Summer	21.243	0.743	28.7	850.9	O K
720 min Summer	21.224	0.724	28.7	824.0	O K
960 min Summer	21.177	0.677	28.7	760.9	O K
1440 min Summer	21.139	0.639	28.7	710.7	O K
2160 min Summer	21.057	0.557	28.7	605.1	O K
2880 min Summer	20.963	0.463	28.7	489.4	O K
4320 min Summer	20.828	0.328	28.6	333.1	O K
5760 min Summer	20.754	0.254	28.0	251.9	O K
7200 min Summer	20.722	0.222	26.5	218.1	O K
8640 min Summer	20.706	0.206	24.4	201.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	589.9	152
30 min Summer	90.183	0.0	795.3	168
60 min Summer	57.866	0.0	1034.4	196
120 min Summer	32.885	0.0	1176.4	250
180 min Summer	23.621	0.0	1267.8	302
240 min Summer	18.682	0.0	1337.2	354
360 min Summer	13.435	0.0	1442.7	444
480 min Summer	10.653	0.0	1525.5	526
600 min Summer	8.910	0.0	1594.8	608
720 min Summer	7.706	0.0	1655.2	686
960 min Summer	6.140	0.0	1758.0	818
1440 min Summer	4.483	0.0	1924.1	1008
2160 min Summer	3.294	0.0	2130.1	1324
2880 min Summer	2.663	0.0	2296.0	1676
4320 min Summer	2.002	0.0	2583.9	2360
5760 min Summer	1.655	0.0	2857.4	3024
7200 min Summer	1.442	0.0	3111.6	3704
8640 min Summer	1.297	0.0	3358.5	4416

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Cascade Summary of Results for Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	20.695	0.195	22.8	189.8	O K
15 min Winter	20.851	0.351	28.6	358.8	O K
30 min Winter	21.040	0.540	28.7	584.0	O K
60 min Winter	21.225	0.725	28.7	826.3	O K
120 min Winter	21.292	0.792	28.7	919.5	O K
180 min Winter	21.318	0.818	28.7	955.9	O K
240 min Winter	21.327	0.827	28.7	968.6	O K
360 min Winter	21.330	0.830	28.7	972.7	O K
480 min Winter	21.326	0.826	28.7	966.9	O K
600 min Winter	21.317	0.817	28.7	954.1	O K
720 min Winter	21.304	0.804	28.7	936.3	O K
960 min Winter	21.255	0.755	28.7	866.8	O K
1440 min Winter	21.202	0.702	28.7	795.0	O K
2160 min Winter	21.023	0.523	28.7	563.1	O K
2880 min Winter	20.877	0.377	28.7	388.3	O K
4320 min Winter	20.729	0.229	27.4	225.6	O K
5760 min Winter	20.696	0.196	23.0	191.7	O K
7200 min Winter	20.678	0.178	20.2	173.1	O K
8640 min Winter	20.666	0.166	18.2	161.0	O K
10080 min Winter	20.658	0.158	16.8	152.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.193	0.0	3599.6	5144
15 min Winter	134.447	0.0	662.2	154
30 min Winter	90.183	0.0	891.9	170
60 min Winter	57.866	0.0	1159.2	196
120 min Winter	32.885	0.0	1318.3	246
180 min Winter	23.621	0.0	1420.7	300
240 min Winter	18.682	0.0	1498.4	354
360 min Winter	13.435	0.0	1616.6	452
480 min Winter	10.653	0.0	1709.3	542
600 min Winter	8.910	0.0	1786.9	630
720 min Winter	7.706	0.0	1854.6	716
960 min Winter	6.140	0.0	1969.8	870
1440 min Winter	4.483	0.0	2155.8	1028
2160 min Winter	3.294	0.0	2386.4	1392
2880 min Winter	2.663	0.0	2572.3	1728
4320 min Winter	2.002	0.0	2895.7	2292
5760 min Winter	1.655	0.0	3200.7	3000
7200 min Winter	1.442	0.0	3485.6	3720
8640 min Winter	1.297	0.0	3762.4	4440
10080 min Winter	1.193	0.0	4033.6	5152

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Cascade Rainfall Details for Basin I.srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.011

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.501	4	8	0.510

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Cascade Model Details for Basin I.srcx

Storage is Online Cover Level (m) 21.700

Tank or Pond Structure

Invert Level (m) 20.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	918.6	0.401	1160.9	0.801	1419.2	1.200	1692.9
0.101	977.6	0.501	1224.0	0.901	1486.3		
0.201	1037.7	0.601	1288.1	1.001	1554.4		
0.301	1098.8	0.701	1353.1	1.101	1623.5		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SFF-0234-2960-0900-2870
Design Head (m)	0.900
Design Flow (l/s)	29.6
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	234
Invert Level (m)	20.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	29.6
Flush-Flo™	0.360	28.7
Kick-Flo®	0.653	25.4
Mean Flow over Head Range	-	23.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	34.0	3.000	52.8	7.000	79.7
0.200	23.6	1.400	36.6	3.500	56.9	7.500	82.5
0.300	28.5	1.600	39.0	4.000	60.7	8.000	85.1
0.400	28.6	1.800	41.3	4.500	64.3	8.500	87.7
0.500	28.0	2.000	43.4	5.000	67.7	9.000	90.1
0.600	26.7	2.200	45.5	5.500	70.9	9.500	92.1
0.800	28.0	2.400	47.4	6.000	74.0		
1.000	31.1	2.600	49.3	6.500	76.9		

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Cascade Summary of Results for Basin J.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Basin I.srcx	Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	21.699	0.199	23.9	0.0	23.9	61.1	O K
30 min Summer	21.740	0.240	28.9	0.0	28.9	74.8	O K
60 min Summer	21.768	0.268	29.3	0.0	29.3	84.5	O K
120 min Summer	21.779	0.279	29.5	0.0	29.5	88.7	O K
180 min Summer	21.773	0.273	29.4	0.0	29.4	86.3	O K
240 min Summer	21.760	0.260	29.2	0.0	29.2	82.0	O K
360 min Summer	21.733	0.233	28.6	0.0	28.6	72.7	O K
480 min Summer	21.715	0.215	26.2	0.0	26.2	66.3	O K
600 min Summer	21.700	0.200	24.1	0.0	24.1	61.4	O K
720 min Summer	21.688	0.188	22.2	0.0	22.2	57.5	O K
960 min Summer	21.671	0.171	19.4	0.0	19.4	51.8	O K
1440 min Summer	21.648	0.148	15.5	0.0	15.5	44.5	O K
2160 min Summer	21.628	0.128	12.1	0.0	12.1	38.1	O K
2880 min Summer	21.616	0.116	10.2	0.0	10.2	34.2	O K
4320 min Summer	21.600	0.100	7.8	0.0	7.8	29.3	O K
5760 min Summer	21.590	0.090	6.5	0.0	6.5	26.3	O K
7200 min Summer	21.583	0.083	5.6	0.0	5.6	24.1	O K
8640 min Summer	21.578	0.078	4.9	0.0	4.9	22.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	75.8	0.0	25
30 min Summer	19.618	0.0	101.2	0.0	33
60 min Summer	12.728	0.0	132.2	0.0	50
120 min Summer	8.110	0.0	168.6	0.0	84
180 min Summer	6.206	0.0	193.5	0.0	116
240 min Summer	5.126	0.0	213.2	0.0	148
360 min Summer	3.877	0.0	241.9	0.0	208
480 min Summer	3.179	0.0	264.5	0.0	268
600 min Summer	2.725	0.0	283.5	0.0	328
720 min Summer	2.403	0.0	300.0	0.0	388
960 min Summer	1.972	0.0	328.1	0.0	510
1440 min Summer	1.492	0.0	372.5	0.0	750
2160 min Summer	1.128	0.0	422.8	0.0	1112
2880 min Summer	0.925	0.0	462.2	0.0	1476
4320 min Summer	0.700	0.0	524.4	0.0	2208
5760 min Summer	0.575	0.0	575.1	0.0	2936
7200 min Summer	0.492	0.0	615.7	0.0	3672
8640 min Summer	0.433	0.0	649.9	0.0	4400

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Cascade Summary of Results for Basin J.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	21.573	0.073	4.4	0.0	4.4	21.1	O K
15 min Winter	21.719	0.219	26.8	0.0	26.8	67.8	O K
30 min Winter	21.765	0.265	29.3	0.0	29.3	83.6	O K
60 min Winter	21.794	0.294	29.6	0.0	29.6	94.1	O K
120 min Winter	21.795	0.295	29.6	0.0	29.6	94.3	O K
180 min Winter	21.775	0.275	29.4	0.0	29.4	87.3	O K
240 min Winter	21.752	0.252	29.1	0.0	29.1	79.1	O K
360 min Winter	21.717	0.217	26.5	0.0	26.5	67.1	O K
480 min Winter	21.694	0.194	23.2	0.0	23.2	59.5	O K
600 min Winter	21.678	0.178	20.5	0.0	20.5	54.2	O K
720 min Winter	21.666	0.166	18.5	0.0	18.5	50.2	O K
960 min Winter	21.649	0.149	15.5	0.0	15.5	44.5	O K
1440 min Winter	21.627	0.127	12.0	0.0	12.0	37.7	O K
2160 min Winter	21.609	0.109	9.2	0.0	9.2	32.1	O K
2880 min Winter	21.598	0.098	7.5	0.0	7.5	28.6	O K
4320 min Winter	21.584	0.084	5.7	0.0	5.7	24.5	O K
5760 min Winter	21.576	0.076	4.7	0.0	4.7	22.0	O K
7200 min Winter	21.570	0.070	4.0	0.0	4.0	20.2	O K
8640 min Winter	21.565	0.065	3.6	0.0	3.6	18.8	O K
10080 min Winter	21.562	0.062	3.2	0.0	3.2	17.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	0.389	0.0	680.2	0.0	5080
15 min Winter	29.494	0.0	85.1	0.0	25
30 min Winter	19.618	0.0	113.5	0.0	35
60 min Winter	12.728	0.0	148.1	0.0	54
120 min Winter	8.110	0.0	188.9	0.0	90
180 min Winter	6.206	0.0	216.8	0.0	122
240 min Winter	5.126	0.0	238.9	0.0	154
360 min Winter	3.877	0.0	271.0	0.0	214
480 min Winter	3.179	0.0	296.3	0.0	274
600 min Winter	2.725	0.0	317.6	0.0	334
720 min Winter	2.403	0.0	336.1	0.0	394
960 min Winter	1.972	0.0	367.6	0.0	514
1440 min Winter	1.492	0.0	417.3	0.0	756
2160 min Winter	1.128	0.0	473.6	0.0	1124
2880 min Winter	0.925	0.0	517.8	0.0	1480
4320 min Winter	0.700	0.0	587.5	0.0	2204
5760 min Winter	0.575	0.0	644.1	0.0	2944
7200 min Winter	0.492	0.0	689.7	0.0	3672
8640 min Winter	0.433	0.0	728.0	0.0	4400
10080 min Winter	0.389	0.0	761.9	0.0	5096

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Cascade Rainfall Details for Basin J.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.390

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.348	4	8	0.348	8	12	0.347	12	16	0.347

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Cascade Model Details for Basin J.srcx

Storage is Online Cover Level (m) 22.743

Tank or Pond Structure

Invert Level (m) 21.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	280.0	0.401	392.7	0.801	521.5	1.201	666.4
0.101	306.7	0.501	423.4	0.901	556.3	1.243	682.5
0.201	334.4	0.601	455.1	1.001	592.0		
0.301	363.1	0.701	487.8	1.101	628.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	21.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 22.200

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Cascade Summary of Results for Basin J.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Basin I.srcx	Basin I.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	22.273	0.773	29.9	60.2	88.0	302.1	O K
30 min Summer	22.352	0.852	29.9	181.3	210.5	343.5	O K
60 min Summer	22.375	0.875	29.9	225.0	254.6	356.2	O K
120 min Summer	22.348	0.848	29.9	175.1	204.2	341.7	O K
180 min Summer	22.326	0.826	29.9	137.6	166.3	330.1	O K
240 min Summer	22.309	0.809	29.9	110.7	139.2	321.0	O K
360 min Summer	22.284	0.784	29.9	75.0	103.1	308.1	O K
480 min Summer	22.267	0.767	29.9	52.9	80.7	299.1	O K
600 min Summer	22.254	0.754	29.9	38.2	65.8	292.2	O K
720 min Summer	22.242	0.742	29.9	26.2	53.5	286.5	O K
960 min Summer	22.219	0.719	29.9	7.9	34.8	274.9	O K
1440 min Summer	22.031	0.531	29.9	0.0	29.9	187.9	O K
2160 min Summer	21.826	0.326	29.8	0.0	29.8	105.7	O K
2880 min Summer	21.736	0.236	28.8	0.0	28.8	73.5	O K
4320 min Summer	21.690	0.190	22.5	0.0	22.5	58.0	O K
5760 min Summer	21.667	0.167	18.7	0.0	18.7	50.6	O K
7200 min Summer	21.654	0.154	16.4	0.0	16.4	46.1	O K
8640 min Summer	21.644	0.144	14.7	0.0	14.7	43.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	349.3	31.0	25
30 min Summer	90.183	0.0	468.9	132.1	32
60 min Summer	57.866	0.0	602.7	231.6	46
120 min Summer	32.885	0.0	685.1	244.2	78
180 min Summer	23.621	0.0	738.2	228.2	108
240 min Summer	18.682	0.0	778.5	206.9	140
360 min Summer	13.435	0.0	839.8	168.2	206
480 min Summer	10.653	0.0	887.8	133.9	272
600 min Summer	8.910	0.0	928.2	102.4	340
720 min Summer	7.706	0.0	963.4	72.7	412
960 min Summer	6.140	0.0	1023.3	17.9	566
1440 min Summer	4.483	0.0	1120.6	0.0	824
2160 min Summer	3.294	0.0	1235.7	0.0	1152
2880 min Summer	2.663	0.0	1332.3	0.0	1476
4320 min Summer	2.002	0.0	1501.6	0.0	2204
5760 min Summer	1.655	0.0	1655.8	0.0	2936
7200 min Summer	1.442	0.0	1803.4	0.0	3672
8640 min Summer	1.297	0.0	1947.3	0.0	4400

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Cascade Summary of Results for Basin J.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	21.637	0.137	13.5	0.0	13.5	40.8	O K
15 min Winter	22.315	0.815	29.9	120.0	148.6	324.0	O K
30 min Winter	22.381	0.881	29.9	236.7	266.3	359.5	O K
60 min Winter	22.392	0.892	29.9	258.5	288.4	365.8	O K
120 min Winter	22.352	0.852	29.9	182.2	211.4	343.9	O K
180 min Winter	22.325	0.825	29.9	135.9	164.7	329.2	O K
240 min Winter	22.306	0.806	29.9	105.5	133.9	319.2	O K
360 min Winter	22.280	0.780	29.9	69.7	97.7	305.9	O K
480 min Winter	22.263	0.763	29.9	48.8	76.5	297.1	O K
600 min Winter	22.250	0.750	29.9	34.5	62.0	290.5	O K
720 min Winter	22.239	0.739	29.9	23.4	50.7	284.7	O K
960 min Winter	22.206	0.706	29.9	1.3	29.9	268.4	O K
1440 min Winter	21.886	0.386	29.9	0.0	29.9	128.4	O K
2160 min Winter	21.718	0.218	26.6	0.0	26.6	67.4	O K
2880 min Winter	21.685	0.185	21.7	0.0	21.7	56.4	O K
4320 min Winter	21.654	0.154	16.4	0.0	16.4	46.2	O K
5760 min Winter	21.637	0.137	13.6	0.0	13.6	40.8	O K
7200 min Winter	21.626	0.126	11.8	0.0	11.8	37.4	O K
8640 min Winter	21.619	0.119	10.6	0.0	10.6	35.2	O K
10080 min Winter	21.613	0.113	9.8	0.0	9.8	33.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.193	0.0	2089.3	0.0	5136
15 min Winter	134.447	0.0	391.3	68.0	24
30 min Winter	90.183	0.0	525.3	185.3	31
60 min Winter	57.866	0.0	675.1	300.7	46
120 min Winter	32.885	0.0	767.4	321.9	78
180 min Winter	23.621	0.0	826.8	309.1	110
240 min Winter	18.682	0.0	872.0	284.2	142
360 min Winter	13.435	0.0	940.6	231.9	208
480 min Winter	10.653	0.0	994.5	182.5	276
600 min Winter	8.910	0.0	1039.7	134.7	348
720 min Winter	7.706	0.0	1079.1	88.6	426
960 min Winter	6.140	0.0	1146.2	1.9	626
1440 min Winter	4.483	0.0	1255.1	0.0	838
2160 min Winter	3.294	0.0	1384.0	0.0	1120
2880 min Winter	2.663	0.0	1492.2	0.0	1476
4320 min Winter	2.002	0.0	1682.0	0.0	2204
5760 min Winter	1.655	0.0	1854.5	0.0	2936
7200 min Winter	1.442	0.0	2019.9	0.0	3672
8640 min Winter	1.297	0.0	2181.1	0.0	4408
10080 min Winter	1.193	0.0	2340.2	0.0	5136

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Cascade Rainfall Details for Basin J.srcx

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.390

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.348	4	8	0.348	8	12	0.347	12	16	0.347

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Cascade Model Details for Basin J.srcx

Storage is Online Cover Level (m) 22.743

Tank or Pond Structure

Invert Level (m) 21.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	280.0	0.401	392.7	0.801	521.5	1.201	666.4
0.101	306.7	0.501	423.4	0.901	556.3	1.243	682.5
0.201	334.4	0.601	455.1	1.001	592.0		
0.301	363.1	0.701	487.8	1.101	628.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0238-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	238
Invert Level (m)	21.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	30.0
Flush-Flo™	0.372	29.9
Kick-Flo®	0.690	26.4
Mean Flow over Head Range	-	24.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.8	1.200	34.4	3.000	53.5	7.000	80.8
0.200	24.0	1.400	37.0	3.500	57.7	7.500	83.5
0.300	29.7	1.600	39.5	4.000	61.5	8.000	86.2
0.400	29.9	1.800	41.8	4.500	65.1	8.500	88.8
0.500	29.4	2.000	44.0	5.000	68.6	9.000	91.3
0.600	28.4	2.200	46.1	5.500	71.8	9.500	93.2
0.800	28.3	2.400	48.0	6.000	74.9		
1.000	31.5	2.600	49.9	6.500	77.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 22.200

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.371	0.071	3.4	59.1	O K
30 min Summer	19.391	0.091	5.2	76.3	O K
60 min Summer	19.410	0.110	7.1	92.9	O K
120 min Summer	19.424	0.124	8.5	105.5	O K
180 min Summer	19.432	0.132	9.4	112.3	O K
240 min Summer	19.436	0.136	9.8	116.5	O K
360 min Summer	19.440	0.140	10.2	119.6	O K
480 min Summer	19.440	0.140	10.2	119.9	O K
600 min Summer	19.439	0.139	10.1	118.9	O K
720 min Summer	19.437	0.137	9.9	117.3	O K
960 min Summer	19.433	0.133	9.5	113.3	O K
1440 min Summer	19.424	0.124	8.5	105.4	O K
2160 min Summer	19.413	0.113	7.4	95.6	O K
2880 min Summer	19.404	0.104	6.5	88.2	O K
4320 min Summer	19.393	0.093	5.4	77.9	O K
5760 min Summer	19.385	0.085	4.6	71.0	O K
7200 min Summer	19.379	0.079	4.0	65.8	O K
8640 min Summer	19.374	0.074	3.6	61.7	O K
10080 min Summer	19.370	0.070	3.3	58.5	O K
15 min Winter	19.379	0.079	4.1	66.0	O K
30 min Winter	19.401	0.101	6.2	85.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	52.0	22
30 min Summer	19.618	0.0	71.6	36
60 min Summer	12.728	0.0	100.2	62
120 min Summer	8.110	0.0	128.9	100
180 min Summer	6.206	0.0	148.6	130
240 min Summer	5.126	0.0	164.1	164
360 min Summer	3.877	0.0	186.7	232
480 min Summer	3.179	0.0	204.5	298
600 min Summer	2.725	0.0	219.3	364
720 min Summer	2.403	0.0	232.2	430
960 min Summer	1.972	0.0	254.0	556
1440 min Summer	1.492	0.0	287.9	806
2160 min Summer	1.128	0.0	331.9	1172
2880 min Summer	0.925	0.0	362.6	1532
4320 min Summer	0.700	0.0	409.4	2252
5760 min Summer	0.575	0.0	453.9	3000
7200 min Summer	0.492	0.0	485.6	3744
8640 min Summer	0.433	0.0	511.7	4416
10080 min Summer	0.389	0.0	533.7	5152
15 min Winter	29.494	0.0	59.1	22
30 min Winter	19.618	0.0	81.2	35

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.422	0.122	8.4	103.9	O K
120 min Winter	19.437	0.137	9.9	117.5	O K
180 min Winter	19.445	0.145	10.6	124.1	O K
240 min Winter	19.448	0.148	10.9	127.3	O K
360 min Winter	19.448	0.148	11.0	127.4	O K
480 min Winter	19.446	0.146	10.7	125.1	O K
600 min Winter	19.442	0.142	10.4	121.8	O K
720 min Winter	19.438	0.138	10.0	118.2	O K
960 min Winter	19.431	0.131	9.3	111.4	O K
1440 min Winter	19.418	0.118	7.9	100.0	O K
2160 min Winter	19.404	0.104	6.5	87.8	O K
2880 min Winter	19.394	0.094	5.5	79.4	O K
4320 min Winter	19.382	0.082	4.4	68.6	O K
5760 min Winter	19.374	0.074	3.6	61.7	O K
7200 min Winter	19.368	0.068	3.1	56.8	O K
8640 min Winter	19.364	0.064	2.8	53.0	O K
10080 min Winter	19.360	0.060	2.5	50.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	112.8	62
120 min Winter	8.110	0.0	145.0	102
180 min Winter	6.206	0.0	167.1	138
240 min Winter	5.126	0.0	184.4	176
360 min Winter	3.877	0.0	209.7	248
480 min Winter	3.179	0.0	229.6	318
600 min Winter	2.725	0.0	246.3	386
720 min Winter	2.403	0.0	260.8	452
960 min Winter	1.972	0.0	285.2	580
1440 min Winter	1.492	0.0	323.3	834
2160 min Winter	1.128	0.0	372.2	1208
2880 min Winter	0.925	0.0	406.6	1564
4320 min Winter	0.700	0.0	459.5	2292
5760 min Winter	0.575	0.0	508.6	3000
7200 min Winter	0.492	0.0	544.2	3752
8640 min Winter	0.433	0.0	573.7	4496
10080 min Winter	0.389	0.0	598.7	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.102

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.500	4	8	0.602

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	806.9	0.201	954.3	0.501	1182.8	0.801	1420.4
0.001	806.9	0.301	1029.5	0.601	1261.0	0.900	1500.8
0.101	880.1	0.401	1105.6	0.701	1340.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0172-1350-0600-1350
Design Head (m)	0.600
Design Flow (l/s)	13.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	172
Invert Level (m)	19.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	13.5
Flush-Flo™	0.260	13.5
Kick-Flo®	0.469	12.0
Mean Flow over Head Range	-	10.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	18.7	3.000	29.1	7.000	43.6
0.200	13.3	1.400	20.2	3.500	31.3	7.500	45.2
0.300	13.4	1.600	21.5	4.000	33.4	8.000	46.7
0.400	12.9	1.800	22.8	4.500	35.4	8.500	48.1
0.500	12.4	2.000	23.9	5.000	37.2	9.000	49.6
0.600	13.5	2.200	25.1	5.500	39.0	9.500	50.9
0.800	15.5	2.400	26.1	6.000	40.7		
1.000	17.2	2.600	27.1	6.500	42.0		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.593	0.293	13.5	267.5	O K
30 min Summer	19.676	0.376	13.5	354.8	O K
60 min Summer	19.757	0.457	13.5	445.4	O K
120 min Summer	19.787	0.487	13.5	480.4	O K
180 min Summer	19.796	0.496	13.5	491.4	O K
240 min Summer	19.797	0.497	13.5	491.9	O K
360 min Summer	19.788	0.488	13.5	481.4	O K
480 min Summer	19.778	0.478	13.5	470.4	O K
600 min Summer	19.768	0.468	13.5	458.7	O K
720 min Summer	19.757	0.457	13.5	446.0	O K
960 min Summer	19.734	0.434	13.5	419.8	O K
1440 min Summer	19.689	0.389	13.5	369.9	O K
2160 min Summer	19.628	0.328	13.5	304.4	O K
2880 min Summer	19.578	0.278	13.5	252.8	O K
4320 min Summer	19.511	0.211	13.4	186.0	O K
5760 min Summer	19.475	0.175	13.1	152.1	O K
7200 min Summer	19.459	0.159	11.8	137.2	O K
8640 min Summer	19.448	0.148	11.0	127.7	O K
10080 min Summer	19.441	0.141	10.3	120.8	O K
15 min Winter	19.625	0.325	13.5	300.6	O K
30 min Winter	19.716	0.416	13.5	399.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	266.3	22
30 min Summer	90.183	0.0	359.9	37
60 min Summer	57.866	0.0	472.3	66
120 min Summer	32.885	0.0	537.4	124
180 min Summer	23.621	0.0	579.2	182
240 min Summer	18.682	0.0	611.0	242
360 min Summer	13.435	0.0	659.3	314
480 min Summer	10.653	0.0	697.1	376
600 min Summer	8.910	0.0	728.9	438
720 min Summer	7.706	0.0	756.5	502
960 min Summer	6.140	0.0	803.5	636
1440 min Summer	4.483	0.0	879.3	898
2160 min Summer	3.294	0.0	976.2	1280
2880 min Summer	2.663	0.0	1052.1	1644
4320 min Summer	2.002	0.0	1183.1	2336
5760 min Summer	1.655	0.0	1310.6	3000
7200 min Summer	1.442	0.0	1427.0	3744
8640 min Summer	1.297	0.0	1539.9	4416
10080 min Summer	1.193	0.0	1649.6	5144
15 min Winter	134.447	0.0	299.2	22
30 min Winter	90.183	0.0	404.0	36

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.805	0.505	13.5	501.9	O K
120 min Winter	19.839	0.539	13.5	543.1	O K
180 min Winter	19.851	0.551	13.5	557.4	O K
240 min Winter	19.854	0.554	13.5	560.3	O K
360 min Winter	19.845	0.545	13.5	550.3	O K
480 min Winter	19.831	0.531	13.5	533.2	O K
600 min Winter	19.819	0.519	13.5	518.4	O K
720 min Winter	19.805	0.505	13.5	502.0	O K
960 min Winter	19.774	0.474	13.5	465.2	O K
1440 min Winter	19.703	0.403	13.5	384.8	O K
2160 min Winter	19.607	0.307	13.5	282.2	O K
2880 min Winter	19.534	0.234	13.5	208.6	O K
4320 min Winter	19.465	0.165	12.3	142.9	O K
5760 min Winter	19.443	0.143	10.5	122.6	O K
7200 min Winter	19.430	0.130	9.2	111.1	O K
8640 min Winter	19.422	0.122	8.3	103.4	O K
10080 min Winter	19.416	0.116	7.7	98.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	529.5	66
120 min Winter	32.885	0.0	602.4	122
180 min Winter	23.621	0.0	649.3	180
240 min Winter	18.682	0.0	684.9	236
360 min Winter	13.435	0.0	738.9	342
480 min Winter	10.653	0.0	781.3	394
600 min Winter	8.910	0.0	816.8	466
720 min Winter	7.706	0.0	847.8	544
960 min Winter	6.140	0.0	900.4	698
1440 min Winter	4.483	0.0	985.4	974
2160 min Winter	3.294	0.0	1093.8	1348
2880 min Winter	2.663	0.0	1178.9	1700
4320 min Winter	2.002	0.0	1326.3	2296
5760 min Winter	1.655	0.0	1468.2	3000
7200 min Winter	1.442	0.0	1598.7	3744
8640 min Winter	1.297	0.0	1725.3	4416
10080 min Winter	1.193	0.0	1849.0	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.102

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.500	4	8	0.602

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	806.9	0.201	954.3	0.501	1182.8	0.801	1420.4
0.001	806.9	0.301	1029.5	0.601	1261.0	0.900	1500.8
0.101	880.1	0.401	1105.6	0.701	1340.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0172-1350-0600-1350
Design Head (m)	0.600
Design Flow (l/s)	13.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	172
Invert Level (m)	19.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	13.5
Flush-Flo™	0.260	13.5
Kick-Flo®	0.469	12.0
Mean Flow over Head Range	-	10.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	18.7	3.000	29.1	7.000	43.6
0.200	13.3	1.400	20.2	3.500	31.3	7.500	45.2
0.300	13.4	1.600	21.5	4.000	33.4	8.000	46.7
0.400	12.9	1.800	22.8	4.500	35.4	8.500	48.1
0.500	12.4	2.000	23.9	5.000	37.2	9.000	49.6
0.600	13.5	2.200	25.1	5.500	39.0	9.500	50.9
0.800	15.5	2.400	26.1	6.000	40.7		
1.000	17.2	2.600	27.1	6.500	42.0		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.104	0.104	9.1	191.2	O K
30 min Summer	19.133	0.133	14.1	247.6	O K
60 min Summer	19.162	0.162	19.9	305.1	O K
120 min Summer	19.185	0.185	24.5	350.9	O K
180 min Summer	19.197	0.197	26.9	374.1	O K
240 min Summer	19.205	0.205	28.5	389.3	O K
360 min Summer	19.211	0.211	29.8	402.4	O K
480 min Summer	19.213	0.213	30.0	406.2	O K
600 min Summer	19.212	0.212	29.9	405.3	O K
720 min Summer	19.211	0.211	29.7	401.8	O K
960 min Summer	19.206	0.206	28.7	391.3	O K
1440 min Summer	19.194	0.194	26.2	367.7	O K
2160 min Summer	19.178	0.178	23.0	336.0	O K
2880 min Summer	19.166	0.166	20.6	311.3	O K
4320 min Summer	19.148	0.148	17.0	276.3	O K
5760 min Summer	19.136	0.136	14.7	252.5	O K
7200 min Summer	19.126	0.126	12.9	234.4	O K
8640 min Summer	19.119	0.119	11.6	219.7	O K
10080 min Summer	19.113	0.113	10.6	208.4	O K
15 min Winter	19.115	0.115	11.0	213.6	O K
30 min Winter	19.148	0.148	17.0	276.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	163.5	29
30 min Summer	19.618	0.0	226.7	42
60 min Summer	12.728	0.0	322.0	66
120 min Summer	8.110	0.0	415.0	110
180 min Summer	6.206	0.0	478.8	140
240 min Summer	5.126	0.0	529.1	172
360 min Summer	3.877	0.0	602.2	240
480 min Summer	3.179	0.0	659.6	306
600 min Summer	2.725	0.0	707.6	374
720 min Summer	2.403	0.0	749.3	438
960 min Summer	1.972	0.0	819.8	566
1440 min Summer	1.492	0.0	928.7	816
2160 min Summer	1.128	0.0	1074.8	1188
2880 min Summer	0.925	0.0	1173.8	1556
4320 min Summer	0.700	0.0	1324.5	2292
5760 min Summer	0.575	0.0	1471.5	3000
7200 min Summer	0.492	0.0	1573.9	3744
8640 min Summer	0.433	0.0	1658.3	4424
10080 min Summer	0.389	0.0	1728.3	5152
15 min Winter	29.494	0.0	186.4	29
30 min Winter	19.618	0.0	257.5	41

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.180	0.180	23.5	340.8	O K
120 min Winter	19.206	0.206	28.7	391.8	O K
180 min Winter	19.217	0.217	30.9	414.8	O K
240 min Winter	19.224	0.224	32.1	427.7	O K
360 min Winter	19.226	0.226	32.5	432.9	O K
480 min Winter	19.224	0.224	32.1	428.4	O K
600 min Winter	19.220	0.220	31.4	420.0	O K
720 min Winter	19.215	0.215	30.4	410.1	O K
960 min Winter	19.205	0.205	28.5	389.6	O K
1440 min Winter	19.187	0.187	24.8	353.1	O K
2160 min Winter	19.166	0.166	20.6	312.0	O K
2880 min Winter	19.151	0.151	17.7	283.1	O K
4320 min Winter	19.132	0.132	13.9	245.1	O K
5760 min Winter	19.119	0.119	11.7	220.8	O K
7200 min Winter	19.110	0.110	10.1	203.2	O K
8640 min Winter	19.103	0.103	8.9	189.6	O K
10080 min Winter	19.097	0.097	8.1	178.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	362.8	66
120 min Winter	8.110	0.0	467.0	114
180 min Winter	6.206	0.0	538.6	146
240 min Winter	5.126	0.0	594.9	182
360 min Winter	3.877	0.0	676.8	256
480 min Winter	3.179	0.0	741.2	326
600 min Winter	2.725	0.0	795.1	396
720 min Winter	2.403	0.0	841.9	462
960 min Winter	1.972	0.0	921.1	594
1440 min Winter	1.492	0.0	1043.7	848
2160 min Winter	1.128	0.0	1205.3	1220
2880 min Winter	0.925	0.0	1316.6	1588
4320 min Winter	0.700	0.0	1486.8	2332
5760 min Winter	0.575	0.0	1649.1	3056
7200 min Winter	0.492	0.0	1764.2	3760
8640 min Winter	0.433	0.0	1859.4	4504
10080 min Winter	0.389	0.0	1939.6	5240

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.576

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.894	4	8	0.894	8	12	0.894	12	16	0.894

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1787.7	0.401	2247.7	0.801	2723.7	1.200	3214.5
0.101	1901.2	0.501	2365.2	0.901	2845.2		
0.201	2015.7	0.601	2483.7	1.001	2967.7		
0.301	2131.2	0.701	2603.2	1.101	3091.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0267-3950-0900-3950
Design Head (m)	0.900
Design Flow (l/s)	39.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	19.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	39.5
Flush-Flo™	0.401	39.5
Kick-Flo®	0.706	35.2
Mean Flow over Head Range	-	31.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.4	3.000	70.6	7.000	106.7
0.200	27.5	1.400	48.9	3.500	76.1	7.500	110.4
0.300	38.8	1.600	52.1	4.000	81.3	8.000	113.9
0.400	39.5	1.800	55.2	4.500	86.0	8.500	117.4
0.500	39.0	2.000	58.0	5.000	90.6	9.000	120.7
0.600	37.8	2.200	60.8	5.500	94.9	9.500	123.1
0.800	37.3	2.400	63.4	6.000	99.0		
1.000	41.6	2.600	65.9	6.500	102.9		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.424	0.424	39.5	860.4	O K
30 min Summer	19.546	0.546	39.5	1146.2	O K
60 min Summer	19.666	0.666	39.5	1446.5	O K
120 min Summer	19.715	0.715	39.5	1573.4	O K
180 min Summer	19.734	0.734	39.5	1621.8	O K
240 min Summer	19.739	0.739	39.5	1635.8	O K
360 min Summer	19.731	0.731	39.5	1615.1	O K
480 min Summer	19.720	0.720	39.5	1584.8	O K
600 min Summer	19.708	0.708	39.5	1552.9	O K
720 min Summer	19.694	0.694	39.5	1518.3	O K
960 min Summer	19.666	0.666	39.5	1445.6	O K
1440 min Summer	19.609	0.609	39.5	1301.1	O K
2160 min Summer	19.527	0.527	39.5	1102.0	O K
2880 min Summer	19.458	0.458	39.5	937.6	O K
4320 min Summer	19.355	0.355	39.3	707.3	O K
5760 min Summer	19.292	0.292	38.6	570.9	O K
7200 min Summer	19.258	0.258	37.7	498.3	O K
8640 min Summer	19.240	0.240	34.9	461.7	O K
10080 min Summer	19.228	0.228	32.8	436.9	O K
15 min Winter	19.470	0.470	39.5	967.3	O K
30 min Winter	19.605	0.605	39.5	1290.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	856.0	29
30 min Summer	90.183	0.0	1158.4	43
60 min Summer	57.866	0.0	1528.3	72
120 min Summer	32.885	0.0	1739.0	130
180 min Summer	23.621	0.0	1874.6	186
240 min Summer	18.682	0.0	1977.6	244
360 min Summer	13.435	0.0	2133.8	342
480 min Summer	10.653	0.0	2256.3	396
600 min Summer	8.910	0.0	2358.8	458
720 min Summer	7.706	0.0	2448.1	520
960 min Summer	6.140	0.0	2599.9	654
1440 min Summer	4.483	0.0	2844.1	920
2160 min Summer	3.294	0.0	3165.1	1308
2880 min Summer	2.663	0.0	3410.9	1680
4320 min Summer	2.002	0.0	3834.2	2384
5760 min Summer	1.655	0.0	4251.3	3064
7200 min Summer	1.442	0.0	4628.7	3744
8640 min Summer	1.297	0.0	4994.2	4424
10080 min Summer	1.193	0.0	5348.6	5152
15 min Winter	134.447	0.0	962.5	29
30 min Winter	90.183	0.0	1300.6	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	19.738	0.738	39.5	1631.9	O K
120 min Winter	19.792	0.792	39.5	1778.8	O K
180 min Winter	19.814	0.814	39.5	1838.2	O K
240 min Winter	19.822	0.822	39.5	1859.9	O K
360 min Winter	19.818	0.818	39.5	1848.0	O K
480 min Winter	19.802	0.802	39.5	1803.7	O K
600 min Winter	19.785	0.785	39.5	1759.4	O K
720 min Winter	19.769	0.769	39.5	1715.8	O K
960 min Winter	19.732	0.732	39.5	1616.9	O K
1440 min Winter	19.643	0.643	39.5	1387.9	O K
2160 min Winter	19.514	0.514	39.5	1069.9	O K
2880 min Winter	19.407	0.407	39.5	821.6	O K
4320 min Winter	19.274	0.274	38.3	532.0	O K
5760 min Winter	19.233	0.233	33.7	446.5	O K
7200 min Winter	19.211	0.211	29.8	402.9	O K
8640 min Winter	19.197	0.197	26.9	374.6	O K
10080 min Winter	19.187	0.187	24.9	354.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1713.6	72
120 min Winter	32.885	0.0	1949.6	128
180 min Winter	23.621	0.0	2101.5	184
240 min Winter	18.682	0.0	2216.8	240
360 min Winter	13.435	0.0	2391.8	350
480 min Winter	10.653	0.0	2528.9	450
600 min Winter	8.910	0.0	2643.7	482
720 min Winter	7.706	0.0	2743.6	558
960 min Winter	6.140	0.0	2913.3	714
1440 min Winter	4.483	0.0	3187.1	1002
2160 min Winter	3.294	0.0	3546.6	1392
2880 min Winter	2.663	0.0	3822.5	1756
4320 min Winter	2.002	0.0	4298.6	2380
5760 min Winter	1.655	0.0	4762.7	3056
7200 min Winter	1.442	0.0	5185.7	3752
8640 min Winter	1.297	0.0	5596.1	4496
10080 min Winter	1.193	0.0	5995.8	5152

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.576

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.894	4	8	0.894	8	12	0.894	12	16	0.894

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Model Details

Storage is Online Cover Level (m) 20.200

Tank or Pond Structure

Invert Level (m) 19.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1787.7	0.401	2247.7	0.801	2723.7	1.200	3214.5
0.101	1901.2	0.501	2365.2	0.901	2845.2		
0.201	2015.7	0.601	2483.7	1.001	2967.7		
0.301	2131.2	0.701	2603.2	1.101	3091.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0267-3950-0900-3950
Design Head (m)	0.900
Design Flow (l/s)	39.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	19.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	39.5
Flush-Flo™	0.401	39.5
Kick-Flo®	0.706	35.2
Mean Flow over Head Range	-	31.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	45.4	3.000	70.6	7.000	106.7
0.200	27.5	1.400	48.9	3.500	76.1	7.500	110.4
0.300	38.8	1.600	52.1	4.000	81.3	8.000	113.9
0.400	39.5	1.800	55.2	4.500	86.0	8.500	117.4
0.500	39.0	2.000	58.0	5.000	90.6	9.000	120.7
0.600	37.8	2.200	60.8	5.500	94.9	9.500	123.1
0.800	37.3	2.400	63.4	6.000	99.0		
1.000	41.6	2.600	65.9	6.500	102.9		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.392	0.092	5.7	75.4	O K
30 min Summer	18.417	0.117	8.6	96.6	O K
60 min Summer	18.441	0.141	11.5	116.8	O K
120 min Summer	18.458	0.158	13.5	131.9	O K
180 min Summer	18.467	0.167	14.4	139.7	O K
240 min Summer	18.472	0.172	14.9	143.9	O K
360 min Summer	18.474	0.174	15.1	145.8	O K
480 min Summer	18.473	0.173	14.9	144.5	O K
600 min Summer	18.470	0.170	14.7	141.9	O K
720 min Summer	18.466	0.166	14.3	138.7	O K
960 min Summer	18.459	0.159	13.5	132.2	O K
1440 min Summer	18.446	0.146	12.1	120.7	O K
2160 min Summer	18.431	0.131	10.3	107.9	O K
2880 min Summer	18.420	0.120	8.9	98.8	O K
4320 min Summer	18.406	0.106	7.3	86.6	O K
5760 min Summer	18.396	0.096	6.2	78.5	O K
7200 min Summer	18.389	0.089	5.4	72.7	O K
8640 min Summer	18.384	0.084	4.8	68.2	O K
10080 min Summer	18.379	0.079	4.4	64.5	O K
15 min Winter	18.403	0.103	6.9	84.2	O K
30 min Winter	18.431	0.131	10.3	107.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	70.9	28
30 min Summer	19.618	0.0	96.8	40
60 min Summer	12.728	0.0	132.6	64
120 min Summer	8.110	0.0	170.2	98
180 min Summer	6.206	0.0	195.9	130
240 min Summer	5.126	0.0	216.2	164
360 min Summer	3.877	0.0	245.7	232
480 min Summer	3.179	0.0	268.9	298
600 min Summer	2.725	0.0	288.4	362
720 min Summer	2.403	0.0	305.3	426
960 min Summer	1.972	0.0	334.0	550
1440 min Summer	1.492	0.0	378.6	794
2160 min Summer	1.128	0.0	434.4	1160
2880 min Summer	0.925	0.0	474.7	1528
4320 min Summer	0.700	0.0	536.7	2252
5760 min Summer	0.575	0.0	593.1	2992
7200 min Summer	0.492	0.0	634.6	3680
8640 min Summer	0.433	0.0	669.1	4416
10080 min Summer	0.389	0.0	698.4	5152
15 min Winter	29.494	0.0	80.3	28
30 min Winter	19.618	0.0	109.3	40

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.457	0.157	13.3	130.4	O K
120 min Winter	18.475	0.175	15.2	146.6	O K
180 min Winter	18.483	0.183	15.9	153.4	O K
240 min Winter	18.486	0.186	16.2	155.8	O K
360 min Winter	18.483	0.183	15.9	153.4	O K
480 min Winter	18.477	0.177	15.4	148.4	O K
600 min Winter	18.471	0.171	14.8	142.8	O K
720 min Winter	18.465	0.165	14.2	137.2	O K
960 min Winter	18.453	0.153	12.9	127.3	O K
1440 min Winter	18.436	0.136	10.9	112.2	O K
2160 min Winter	18.418	0.118	8.7	97.3	O K
2880 min Winter	18.407	0.107	7.4	87.6	O K
4320 min Winter	18.392	0.092	5.7	75.3	O K
5760 min Winter	18.383	0.083	4.8	67.7	O K
7200 min Winter	18.377	0.077	4.1	62.2	O K
8640 min Winter	18.371	0.071	3.6	58.1	O K
10080 min Winter	18.368	0.068	3.3	54.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	149.1	64
120 min Winter	8.110	0.0	191.1	102
180 min Winter	6.206	0.0	220.0	138
240 min Winter	5.126	0.0	242.7	176
360 min Winter	3.877	0.0	275.8	246
480 min Winter	3.179	0.0	301.8	314
600 min Winter	2.725	0.0	323.6	380
720 min Winter	2.403	0.0	342.6	446
960 min Winter	1.972	0.0	374.8	572
1440 min Winter	1.492	0.0	424.9	820
2160 min Winter	1.128	0.0	487.0	1188
2880 min Winter	0.925	0.0	532.1	1556
4320 min Winter	0.700	0.0	602.0	2288
5760 min Winter	0.575	0.0	664.6	3000
7200 min Winter	0.492	0.0	711.2	3744
8640 min Winter	0.433	0.0	750.0	4496
10080 min Winter	0.389	0.0	783.3	5224

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.438

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.360	4	8	0.360	8	12	0.360	12	16	0.358

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Model Details

Storage is Online Cover Level (m) 19.500

Tank or Pond Structure

Invert Level (m) 18.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	795.9	0.401	989.2	0.801	1198.5	1.200	1423.4
0.101	842.7	0.501	1040.0	0.901	1253.4		
0.201	890.5	0.601	1091.8	1.001	1309.2		
0.301	939.4	0.701	1144.7	1.101	1366.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0189-1770-0900-1770
Design Head (m)	0.900
Design Flow (l/s)	17.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	189
Invert Level (m)	18.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	17.7
Flush-Flo™	0.318	17.7
Kick-Flo®	0.660	15.3
Mean Flow over Head Range	-	14.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.6	1.200	20.3	3.000	31.4	7.000	47.3
0.200	17.0	1.400	21.8	3.500	33.9	7.500	48.9
0.300	17.7	1.600	23.2	4.000	36.1	8.000	50.5
0.400	17.5	1.800	24.6	4.500	38.2	8.500	52.0
0.500	17.1	2.000	25.9	5.000	40.2	9.000	53.5
0.600	16.3	2.200	27.1	5.500	42.1	9.500	54.7
0.800	16.7	2.400	28.2	6.000	43.9		
1.000	18.6	2.600	29.3	6.500	45.7		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	18.687	0.387	17.7	343.1	O K
30 min Summer	18.799	0.499	17.7	457.1	O K
60 min Summer	18.910	0.610	17.7	575.3	O K
120 min Summer	18.951	0.651	17.7	620.9	O K
180 min Summer	18.964	0.664	17.7	635.5	O K
240 min Summer	18.965	0.665	17.7	636.3	O K
360 min Summer	18.950	0.650	17.7	619.1	O K
480 min Summer	18.933	0.633	17.7	600.6	O K
600 min Summer	18.917	0.617	17.7	582.6	O K
720 min Summer	18.900	0.600	17.7	564.5	O K
960 min Summer	18.867	0.567	17.7	528.2	O K
1440 min Summer	18.803	0.503	17.7	460.8	O K
2160 min Summer	18.717	0.417	17.7	373.3	O K
2880 min Summer	18.647	0.347	17.7	304.6	O K
4320 min Summer	18.552	0.252	17.5	215.9	O K
5760 min Summer	18.502	0.202	17.1	170.5	O K
7200 min Summer	18.481	0.181	15.7	151.9	O K
8640 min Summer	18.468	0.168	14.5	140.7	O K
10080 min Summer	18.459	0.159	13.6	132.6	O K
15 min Winter	18.730	0.430	17.7	386.1	O K
30 min Winter	18.855	0.555	17.7	515.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	351.7	29
30 min Summer	90.183	0.0	474.3	43
60 min Summer	57.866	0.0	618.6	72
120 min Summer	32.885	0.0	703.5	128
180 min Summer	23.621	0.0	758.3	186
240 min Summer	18.682	0.0	799.8	242
360 min Summer	13.435	0.0	862.9	322
480 min Summer	10.653	0.0	912.4	380
600 min Summer	8.910	0.0	954.0	438
720 min Summer	7.706	0.0	990.1	504
960 min Summer	6.140	0.0	1051.7	638
1440 min Summer	4.483	0.0	1151.1	904
2160 min Summer	3.294	0.0	1275.3	1284
2880 min Summer	2.663	0.0	1374.5	1648
4320 min Summer	2.002	0.0	1546.7	2336
5760 min Summer	1.655	0.0	1711.0	3000
7200 min Summer	1.442	0.0	1863.2	3688
8640 min Summer	1.297	0.0	2011.0	4416
10080 min Summer	1.193	0.0	2155.2	5144
15 min Winter	134.447	0.0	394.8	29
30 min Winter	90.183	0.0	532.0	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	18.977	0.677	17.7	650.2	O K
120 min Winter	19.025	0.725	17.7	704.5	O K
180 min Winter	19.041	0.741	17.7	723.6	O K
240 min Winter	19.045	0.745	17.7	727.6	O K
360 min Winter	19.033	0.733	17.7	714.1	O K
480 min Winter	19.011	0.711	17.7	688.8	O K
600 min Winter	18.992	0.692	17.7	666.4	O K
720 min Winter	18.970	0.670	17.7	642.0	O K
960 min Winter	18.920	0.620	17.7	585.9	O K
1440 min Winter	18.820	0.520	17.7	478.4	O K
2160 min Winter	18.686	0.386	17.7	342.0	O K
2880 min Winter	18.583	0.283	17.6	244.4	O K
4320 min Winter	18.487	0.187	16.3	157.2	O K
5760 min Winter	18.461	0.161	13.7	134.1	O K
7200 min Winter	18.446	0.146	12.1	121.1	O K
8640 min Winter	18.436	0.136	10.9	112.7	O K
10080 min Winter	18.429	0.129	10.1	106.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	693.2	72
120 min Winter	32.885	0.0	788.4	126
180 min Winter	23.621	0.0	849.7	184
240 min Winter	18.682	0.0	896.2	240
360 min Winter	13.435	0.0	966.9	348
480 min Winter	10.653	0.0	1022.4	438
600 min Winter	8.910	0.0	1068.8	476
720 min Winter	7.706	0.0	1109.3	554
960 min Winter	6.140	0.0	1178.3	700
1440 min Winter	4.483	0.0	1289.9	978
2160 min Winter	3.294	0.0	1428.7	1356
2880 min Winter	2.663	0.0	1540.0	1696
4320 min Winter	2.002	0.0	1733.5	2296
5760 min Winter	1.655	0.0	1916.7	3000
7200 min Winter	1.442	0.0	2087.2	3744
8640 min Winter	1.297	0.0	2252.9	4416
10080 min Winter	1.193	0.0	2415.2	5144

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.438

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.360	4	8	0.360	8	12	0.360	12	16	0.358

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Model Details

Storage is Online Cover Level (m) 19.500

Tank or Pond Structure

Invert Level (m) 18.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	795.9	0.401	989.2	0.801	1198.5	1.200	1423.4
0.101	842.7	0.501	1040.0	0.901	1253.4		
0.201	890.5	0.601	1091.8	1.001	1309.2		
0.301	939.4	0.701	1144.7	1.101	1366.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0189-1770-0900-1770
Design Head (m)	0.900
Design Flow (l/s)	17.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	189
Invert Level (m)	18.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	17.7
Flush-Flo™	0.318	17.7
Kick-Flo®	0.660	15.3
Mean Flow over Head Range	-	14.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.6	1.200	20.3	3.000	31.4	7.000	47.3
0.200	17.0	1.400	21.8	3.500	33.9	7.500	48.9
0.300	17.7	1.600	23.2	4.000	36.1	8.000	50.5
0.400	17.5	1.800	24.6	4.500	38.2	8.500	52.0
0.500	17.1	2.000	25.9	5.000	40.2	9.000	53.5
0.600	16.3	2.200	27.1	5.500	42.1	9.500	54.7
0.800	16.7	2.400	28.2	6.000	43.9		
1.000	18.6	2.600	29.3	6.500	45.7		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	17.190	0.090	7.3	201.6	O K
30 min Summer	17.217	0.117	11.8	262.5	O K
60 min Summer	17.244	0.144	17.1	326.1	O K
120 min Summer	17.267	0.167	22.0	379.9	O K
180 min Summer	17.278	0.178	24.4	405.0	O K
240 min Summer	17.285	0.185	26.1	422.6	O K
360 min Summer	17.292	0.192	27.7	440.2	O K
480 min Summer	17.296	0.196	28.4	447.7	O K
600 min Summer	17.296	0.196	28.6	449.7	O K
720 min Summer	17.296	0.196	28.4	448.6	O K
960 min Summer	17.293	0.193	27.8	441.4	O K
1440 min Summer	17.284	0.184	25.9	421.1	O K
2160 min Summer	17.271	0.171	23.0	390.4	O K
2880 min Summer	17.261	0.161	20.7	365.1	O K
4320 min Summer	17.245	0.145	17.3	327.7	O K
5760 min Summer	17.233	0.133	14.9	301.0	O K
7200 min Summer	17.224	0.124	13.2	280.8	O K
8640 min Summer	17.217	0.117	11.9	264.3	O K
10080 min Summer	17.212	0.112	10.9	250.8	O K
15 min Winter	17.200	0.100	8.9	225.4	O K
30 min Winter	17.230	0.130	14.3	293.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	29.494	0.0	160.5	30
30 min Summer	19.618	0.0	225.5	42
60 min Summer	12.728	0.0	329.8	68
120 min Summer	8.110	0.0	426.8	120
180 min Summer	6.206	0.0	493.4	146
240 min Summer	5.126	0.0	545.8	178
360 min Summer	3.877	0.0	622.0	244
480 min Summer	3.179	0.0	681.8	312
600 min Summer	2.725	0.0	731.8	378
720 min Summer	2.403	0.0	775.1	444
960 min Summer	1.972	0.0	848.2	574
1440 min Summer	1.492	0.0	960.5	826
2160 min Summer	1.128	0.0	1119.6	1196
2880 min Summer	0.925	0.0	1222.5	1564
4320 min Summer	0.700	0.0	1377.2	2296
5760 min Summer	0.575	0.0	1536.9	3008
7200 min Summer	0.492	0.0	1643.4	3752
8640 min Summer	0.433	0.0	1730.5	4496
10080 min Summer	0.389	0.0	1801.6	5240
15 min Winter	29.494	0.0	184.1	29
30 min Winter	19.618	0.0	257.3	42

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	17.260	0.160	20.6	364.0	O K
120 min Winter	17.286	0.186	26.2	424.2	O K
180 min Winter	17.296	0.196	28.6	449.8	O K
240 min Winter	17.303	0.203	30.1	466.3	O K
360 min Winter	17.308	0.208	31.1	476.9	O K
480 min Winter	17.308	0.208	31.1	476.4	O K
600 min Winter	17.305	0.205	30.6	470.9	O K
720 min Winter	17.302	0.202	29.9	463.2	O K
960 min Winter	17.295	0.195	28.2	445.3	O K
1440 min Winter	17.280	0.180	24.9	410.5	O K
2160 min Winter	17.262	0.162	21.0	368.3	O K
2880 min Winter	17.249	0.149	18.1	337.0	O K
4320 min Winter	17.230	0.130	14.4	294.6	O K
5760 min Winter	17.218	0.118	12.1	266.6	O K
7200 min Winter	17.209	0.109	10.4	246.0	O K
8640 min Winter	17.202	0.102	9.3	230.1	O K
10080 min Winter	17.197	0.097	8.4	217.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	12.728	0.0	372.4	68
120 min Winter	8.110	0.0	481.2	118
180 min Winter	6.206	0.0	555.8	150
240 min Winter	5.126	0.0	614.6	186
360 min Winter	3.877	0.0	700.1	260
480 min Winter	3.179	0.0	767.1	332
600 min Winter	2.725	0.0	823.2	402
720 min Winter	2.403	0.0	871.9	470
960 min Winter	1.972	0.0	954.0	602
1440 min Winter	1.492	0.0	1080.6	860
2160 min Winter	1.128	0.0	1256.2	1236
2880 min Winter	0.925	0.0	1371.9	1600
4320 min Winter	0.700	0.0	1546.9	2344
5760 min Winter	0.575	0.0	1722.9	3064
7200 min Winter	0.492	0.0	1842.5	3824
8640 min Winter	0.433	0.0	1940.9	4576
10080 min Winter	0.389	0.0	2022.7	5256

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.743

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.935	4	8	0.935	8	12	0.935	12	16	0.938

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 18.300

Tank or Pond Structure

Invert Level (m) 17.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2197.7	0.401	2579.3	0.801	2976.7	1.200	3388.8
0.101	2291.7	0.501	2677.2	0.901	3078.5		
0.201	2386.6	0.601	2776.0	1.001	3181.3		
0.301	2482.5	0.701	2875.8	1.101	3285.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0285-4610-0900-4610
Design Head (m)	0.900
Design Flow (l/s)	46.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	285
Invert Level (m)	17.100
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	46.1
Flush-Flo™	0.426	46.0
Kick-Flo®	0.721	41.4
Mean Flow over Head Range	-	36.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.9	1.200	52.9	3.000	82.5	7.000	124.7
0.200	29.4	1.400	57.0	3.500	88.9	7.500	128.9
0.300	44.8	1.600	60.8	4.000	94.9	8.000	133.1
0.400	46.0	1.800	64.4	4.500	100.5	8.500	137.1
0.500	45.7	2.000	67.7	5.000	105.8	9.000	141.0
0.600	44.6	2.200	70.9	5.500	110.8	9.500	143.8
0.800	43.5	2.400	74.0	6.000	115.6		
1.000	48.5	2.600	76.9	6.500	120.2		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	17.479	0.379	45.9	899.6	O K
30 min Summer	17.592	0.492	46.0	1195.6	O K
60 min Summer	17.705	0.605	46.0	1504.6	O K
120 min Summer	17.750	0.650	46.0	1628.8	O K
180 min Summer	17.765	0.665	46.0	1671.6	O K
240 min Summer	17.767	0.667	46.0	1678.8	O K
360 min Summer	17.758	0.658	46.0	1651.6	O K
480 min Summer	17.747	0.647	46.0	1622.1	O K
600 min Summer	17.736	0.636	46.0	1590.1	O K
720 min Summer	17.723	0.623	46.0	1555.2	O K
960 min Summer	17.696	0.596	46.0	1479.4	O K
1440 min Summer	17.641	0.541	46.0	1326.5	O K
2160 min Summer	17.563	0.463	46.0	1118.7	O K
2880 min Summer	17.500	0.400	46.0	953.8	O K
4320 min Summer	17.414	0.314	45.1	737.4	O K
5760 min Summer	17.370	0.270	43.5	626.7	O K
7200 min Summer	17.348	0.248	39.5	573.4	O K
8640 min Summer	17.333	0.233	36.6	536.6	O K
10080 min Summer	17.322	0.222	34.4	511.0	O K
15 min Winter	17.522	0.422	46.0	1010.9	O K
30 min Winter	17.648	0.548	46.0	1346.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	134.447	0.0	881.1	29
30 min Summer	90.183	0.0	1197.1	43
60 min Summer	57.866	0.0	1591.4	72
120 min Summer	32.885	0.0	1811.8	128
180 min Summer	23.621	0.0	1953.6	184
240 min Summer	18.682	0.0	2061.2	242
360 min Summer	13.435	0.0	2224.5	310
480 min Summer	10.653	0.0	2352.5	370
600 min Summer	8.910	0.0	2459.6	434
720 min Summer	7.706	0.0	2552.8	500
960 min Summer	6.140	0.0	2711.1	634
1440 min Summer	4.483	0.0	2965.2	900
2160 min Summer	3.294	0.0	3307.2	1284
2880 min Summer	2.663	0.0	3563.4	1648
4320 min Summer	2.002	0.0	4002.1	2340
5760 min Summer	1.655	0.0	4446.3	3008
7200 min Summer	1.442	0.0	4840.3	3744
8640 min Summer	1.297	0.0	5221.3	4424
10080 min Summer	1.193	0.0	5588.5	5152
15 min Winter	134.447	0.0	992.4	29
30 min Winter	90.183	0.0	1345.8	43

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	17.774	0.674	46.0	1698.0	O K
120 min Winter	17.826	0.726	46.0	1848.0	O K
180 min Winter	17.846	0.746	46.0	1906.2	O K
240 min Winter	17.852	0.752	46.0	1924.3	O K
360 min Winter	17.845	0.745	46.0	1902.4	O K
480 min Winter	17.826	0.726	46.0	1847.9	O K
600 min Winter	17.809	0.709	46.0	1798.7	O K
720 min Winter	17.790	0.690	46.0	1743.6	O K
960 min Winter	17.747	0.647	46.0	1622.1	O K
1440 min Winter	17.658	0.558	46.0	1375.5	O K
2160 min Winter	17.538	0.438	46.0	1052.1	O K
2880 min Winter	17.446	0.346	45.6	816.9	O K
4320 min Winter	17.358	0.258	41.4	598.1	O K
5760 min Winter	17.326	0.226	35.2	521.4	O K
7200 min Winter	17.308	0.208	31.1	476.2	O K
8640 min Winter	17.294	0.194	28.1	445.0	O K
10080 min Winter	17.285	0.185	26.0	422.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.866	0.0	1785.3	72
120 min Winter	32.885	0.0	2032.1	128
180 min Winter	23.621	0.0	2190.9	184
240 min Winter	18.682	0.0	2311.4	240
360 min Winter	13.435	0.0	2494.2	348
480 min Winter	10.653	0.0	2637.5	412
600 min Winter	8.910	0.0	2757.5	472
720 min Winter	7.706	0.0	2862.0	548
960 min Winter	6.140	0.0	3039.5	694
1440 min Winter	4.483	0.0	3324.8	974
2160 min Winter	3.294	0.0	3706.6	1352
2880 min Winter	2.663	0.0	3994.1	1700
4320 min Winter	2.002	0.0	4488.3	2336
5760 min Winter	1.655	0.0	4981.5	3056
7200 min Winter	1.442	0.0	5423.4	3752
8640 min Winter	1.297	0.0	5851.4	4496
10080 min Winter	1.193	0.0	6266.3	5240

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Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448927 117350	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.743

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.935	4	8	0.935	8	12	0.935	12	16	0.938

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

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Model Details

Storage is Online Cover Level (m) 18.300

Tank or Pond Structure

Invert Level (m) 17.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2197.7	0.401	2579.3	0.801	2976.7	1.200	3388.8
0.101	2291.7	0.501	2677.2	0.901	3078.5		
0.201	2386.6	0.601	2776.0	1.001	3181.3		
0.301	2482.5	0.701	2875.8	1.101	3285.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0285-4610-0900-4610
Design Head (m)	0.900
Design Flow (l/s)	46.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	285
Invert Level (m)	17.100
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	46.1
Flush-Flo™	0.426	46.0
Kick-Flo®	0.721	41.4
Mean Flow over Head Range	-	36.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.9	1.200	52.9	3.000	82.5	7.000	124.7
0.200	29.4	1.400	57.0	3.500	88.9	7.500	128.9
0.300	44.8	1.600	60.8	4.000	94.9	8.000	133.1
0.400	46.0	1.800	64.4	4.500	100.5	8.500	137.1
0.500	45.7	2.000	67.7	5.000	105.8	9.000	141.0
0.600	44.6	2.200	70.9	5.500	110.8	9.500	143.8
0.800	43.5	2.400	74.0	6.000	115.6		
1.000	48.5	2.600	76.9	6.500	120.2		

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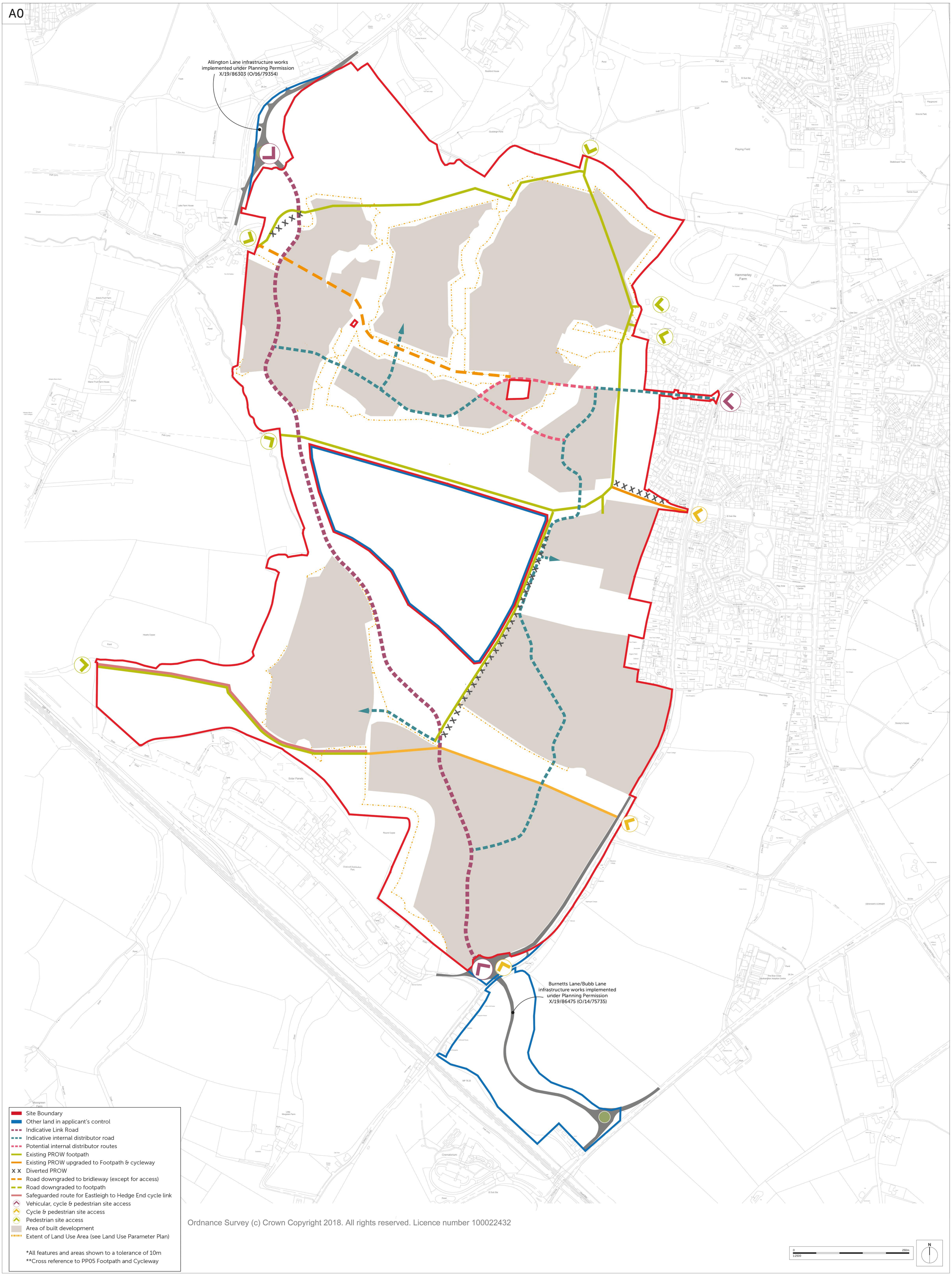
Appendix 12

A0



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www.thrivearchitects.co.uk

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Rev	Description	Date	Au	Ch
P22	Nett & Gross developable areas updated	04.12.20	GR/kn	GR
P23	Link road option added, redline updated, protected route revised	26.04.21	GR/kn	GR
P24	Minor amendments to existing routes including diversions, red & blue line added to solar farm	27.04.21	GR/kn	GR
P25	Distributor road realigned	28.04.21	GR/kn	GR
P26	Title block updated	05.05.21	GR/kn	GR
P27	Blue line amended	06.05.21	GR/kn	GR

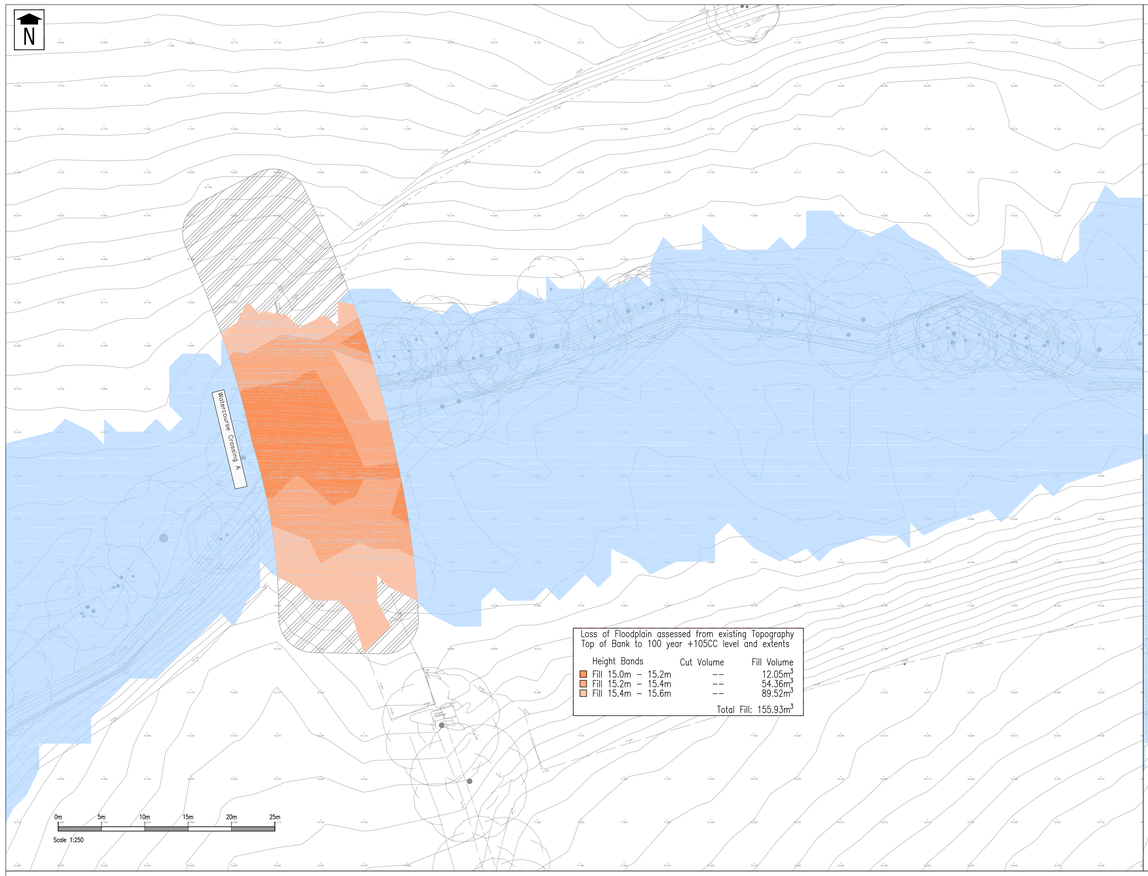
Project **ONE HORTON HEATH**

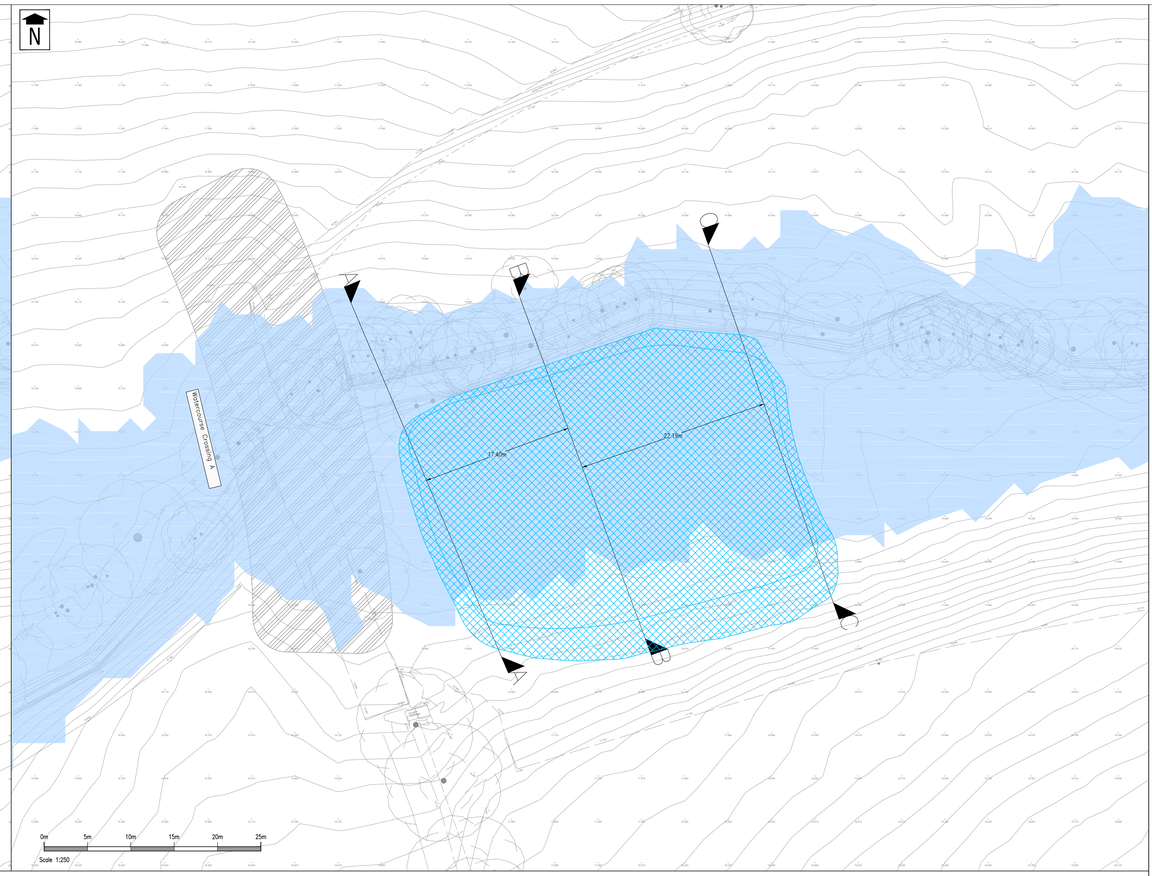
Drawing **Parameter Plan Access**

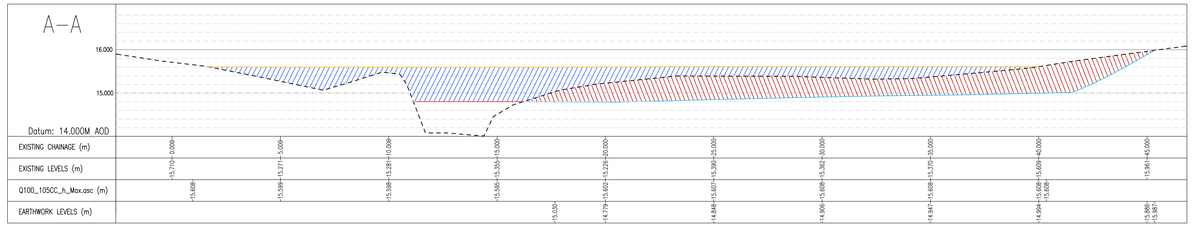
Client	Eastleigh Borough Council				
Job no.	EAST200403			Date	28.05.20
Dwg no.	PP 01			Rev.	P27
Author	GR/kn	Checked	GR	Scale	1:2500@A0
Status				Office	Romsey
Client ref.	-				

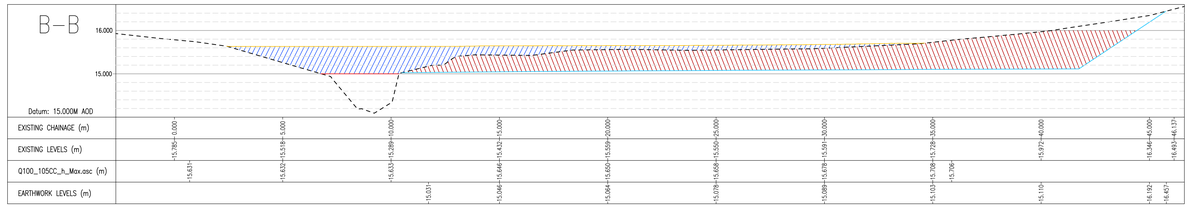
thrive. architects

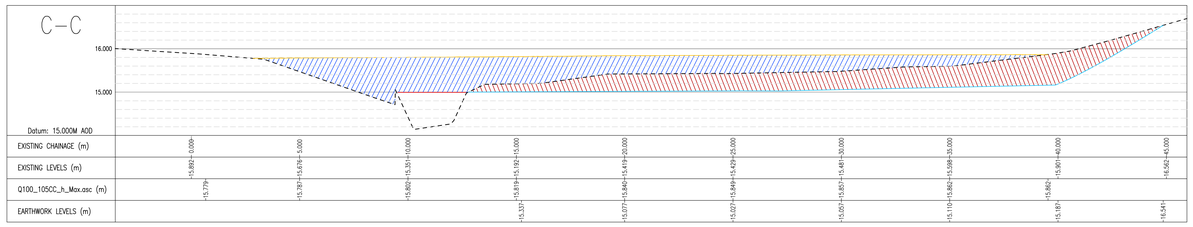
Appendix 13











Sections shown at 1:100 Horizontal Scale & 1:50 Vertical Scale

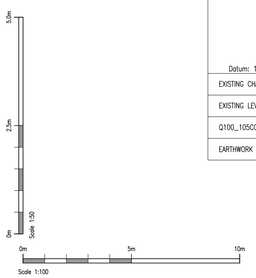


Table 1: Flood Compensation Volumes

Section AA- BB

Slice Level (mAOD)	Additional Sectional Area (m²)	Additional Sectional Area of Adjacent Section (m²)	Average Area (m²)	Compensated Volume (m³) (Length x Area)
15.0-15.2	2.68	3.73	3.195	55.593
15.2-15.4	4.71	5.9	5.305	92.307
15.4-15.6	3.85	4.69	4.27	74.298
15.6-15.8	N/A*	N/A*	N/A*	N/A*

Section BB- CC

Slice Level	Additional Sectional Area	Additional Sectional Area of Adjacent Section	Average Area	Compensated Volume (Length x Area)
15.0-15.2	3.71	3.88	3.795	66.033
15.2-15.4	5.9	4.53	5.205	90.567
15.4-15.6	4.69	2.47	3.58	62.292
15.6-15.8	1.16	1.09	1.12	19.488
15.8-16.0	N/A*	N/A*	N/A*	N/A*

Sections	Length between Sections
AA to BB	17.4
BB to CC	22.19

Slice Level	Total Additional Volume
15.0-15.2	121.626
15.2-15.4	182.874
15.4-15.6	136.59
15.6-15.8	19.488
15.8-16.0	N/A
Total	460.578

PFA consulting

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Website
www.pfaplc.com

For Planning
This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

KEY

- Existing Topography
- 100yr +105%CC Level
- Compensation Earthworks
- Top of Bank
- Existing Flood Plain
- Gained Floodplain
- Q100+105CC Flood extents
- Flood Compensation Area

NOTES

1. This drawing should be read in conjunction with PFA Consulting's Flood Risk Assessment (Doc ref G277–DOC01 FRA – Issue 2) dated May 2020 and supporting drawing G277–21622.
2. This drawing is based on the Topographical Survey undertaken by Mayer Brown Limited, Drawing No:R.SAV.1.21.1, Rev E, dated 05 May 2014.
3. This drawing contains the 100yr + 105 CC Product 6 flood model outputs supplied by the Environment Agency.
4. This drawing has been prepared to show feasibility of level for level floodplain compensation however the watercourse crossing should be clear span of the channel with soffit levels set to at least 600mm above the 1 in 100 year + Climate Change Flood Level..

Rev	Date	Description	Drawn	Check
#	10/05/21	First Issue.	DAB	MWS

Status
FOR PLANNING

Client
Eastleigh Borough Council

Project
One Horton Heath Hampshire

Drawing Title
Indicative Level-for Level Floodplain Storage Compensation on the Fair Oak Stream

Drawing No. **G277/25**

Date: May 2021 | Scale: As Shown @ A0

E-Mail: DBuciak@pfaplc.com

Appendix 14

From:	FWM Statutory SWM Consultee mailbox
To:	Mark Skivington
Cc:	FWM Statutory SWM Consultee mailbox
Subject:	RE: G277 - One Horton Heath - 14/01/2020 Meeting with LLFA
Date:	02 March 2020 12:26:50

Dear Mr Skivington,

Thank you for your email.

I confirm that I agree with the submitted minutes.

Kind regards,
Santi

Santiago Manzanero
Flood and Water Management Engineer
01962 846777
Santi.Manzanero@hants.gov.uk

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www.hants.gov.uk/sharedexpertise

The HCC Flood and Water Management team offer a Flood and Water Management information service for Local Authorities and developers offering both historic site information and a full Pre-Application assessment of a proposed development's Surface Water Drainage features. For specific information please visit the 'Reducing flood risk in planning' webpage or for general information see HCC Flood & Water Management

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From: Mark Skivington <mskivington@pfaplc.com>
Sent: 25 February 2020 15:58
To: FWM Statutory SWM Consultee mailbox <SWM.Consultee@hants.gov.uk>
Cc: 'Cranmer, David' <David.Cranmer@eastleigh.gov.uk>; smillard@pfaplc.com
Subject: G277 - One Horton Heath - 14/01/2020 Meeting with LLFA

Dear Santiago,

Thank you for taking the time to meet with us at your offices last month. I believe that the

following provides a summary of the discussions in relation to the outline planning application.

Broad agreement of the surface water drainage strategy as shown on drawing G277/9 Rev A (attached). HCC confirmed that, for an Outline Application of this scale, Micro Drainage Source Control modelling outputs would be suitable to demonstrate that the proposed strategic SuDS features provide the required attenuation.

Strategic SuDS features to incorporate a series of treatment processes, i.e. sediment forebays, micropools, low flow channels, wetland planting areas and swales for outfalls where possible. Upstream Source Control and green infrastructure measures to be covered by text within drainage strategy / Flood Risk Assessment reports to inform later detailed designs.

Agreement that BGS borehole logs and other evidence is suitable to demonstrate that infiltration drainage is not feasible. If information on groundwater levels is not available SuDS features may need to be clay lined to prevent ingress.

Due to the lack of potential for infiltration drainage it will not be feasible to reduce post-development runoff volumes to the greenfield volume. HCC confirmed that they would accept flow rates for events up to the 1 in 100year + 40% being restricted to Qbar/Qmed as an alternative. The SuDS features shown on G277/9 Rev A have been sized on this basis.

Catchments draining to strategic SuDS features should replicate natural catchments as closely as possible.

HCC to provide guidance on offsets from Ordinary Watercourses. It was mentioned in the meeting that the appropriate offsets are thought to be 8 metres for Main Rivers (EA) and 5 metres for Ordinary Watercourses. HCC to confirm.

PFA to provide Greenfield Runoff calculations for approval by HCC. A Technical Note setting out the Greenfield Runoff calculations is attached.

Please could you confirm that you agree that the above is a fair reflection of our discussions and please let me know if you have any further comments.

Kind regards,

Mark Skivington
Associate Designate

PFA Consulting Ltd
Stratton Park House
Wanborough Road
Swindon
SN3 4HG

T: 01793 828000 **F:** 01793 835500 **E:** mskivington@pfaplc.com **W:** www.pfaplc.com

PFA Consulting Ltd
Company Registered in England 03871018. Registered address as above.

Appendix 15

This document should be read in conjunction with the Surface Water Checklist Guidance document located on our website

SURFACE WATER SUBMITTED INFORMATION

Some applications have a considerable number of documents associated with them. To make sure we are reviewing the correct documentation, please ensure the following table is completed.

Document / Drawing Title	Document / Drawing Reference (and revision)
PFA Consulting's: One Horton Heath, Eastleigh – Flood Risk Assessment	G277-DOC01 Issue 1 & Appendices

PRE-APPLICATION / PREVIOUS PLANNING APPLICATIONS

If this site was subject to a previous planning application i.e. an outline application in relation to a wider strategic site, pre-application enquiry or if you are reliant on information previously submitted, please provide the relevant reference numbers below.

Planning / Pre-app Titles	Reference Number
Pre-application meeting and follow up emails.	Meeting date: 14/01/2020 with Santiago Manzanero

ORDINARY WATERCOURSE CONSENTING – to be completed and signed by the applicant

I confirm that I have reviewed the site and there are watercourses / ditches / flow routes that will be affected or amended by the works. I understand that these works require Ordinary Watercourse Consent under the Land Drainage Act 1991 and confirm that applications will be made for these works prior to works starting on site.

Name:……. **Job Title:…….**

Signature:…….

SURFACE WATER CHECKLIST

Site Name		Planning ref			
Ref	**SURFACE WATER REQUIREMENTS**	**PLANNING STAGE**		**SUBMISSSION CHECKLIST**	
		OUTLINE PLANNING	DETAILED PLANNING	Included Yes/Not	DOCUMENT Ref
	EXISTING INFORMATION	X	X		
1	Topographical Survey.	X	X	Yes	Mayer Brown IR SAV 1.21 Rev E
2	Existing Drainage	X	X	Yes	PFA dwg G277/20
3	Discharge Rates and Volumes	X	X	Yes	FRA
4	Existing Overland Flow Paths	X	X	Yes	PFA dwg G277/20
5	Site Investigations	X	X	Yes	Hydrock Doc ref: HHD-HYD-XX-XX-RP-GE-0002
	OUTLINE DRAINAGE STRATEGY				
6	Confirmation of a discharge location	X	X	Yes	PFA dwg G277/21&22
7	Outline Surface Water Calculations	X		Yes	FRA
8	Flood Risk Assessment / Drainage Strategy	X	X	Yes	FRA
9	Potential Flood Risk	X	X	Yes	FRA
10	Outline Drainage Layout Plan	X		Yes	PFA dwg G277/21,22&23
	DETAILED DRAINAGE STRATEGY		X		
11	Detailed Drainage Assessment		X		
12	Detailed Drainage Layout Drawings		X		
13	Detailed Hydraulic Calculations		X		
14	Water Treatment		X		
15	Exceedance Flows		X		
16	Urban Creep		X		
17	Maintenance		X		